

Australian
National
University

EntoSieve Reproduction & Handover Guide

ENGN8170 Group 01 — EntoSieve Reproduction Project

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School of Engineering / College of Systems and Society

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1. Purpose and How to Use This Guide

This guide describes the EntoSieve reproduction system, its assembly, operation, maintenance and reproduction. It is intended for Dr Megan Head, Dr Josh Coates and future authorised users.

How to use this guide:

- Read System Overview and Safety and Laboratory Procedures (Sections 2 and 3) before operating or assembling the system.
- Use Commissioning and Startup Procedure (Section 7), followed by Standard Operating Procedure (Section 8), for the current three-button configuration.
- For reproduction, use the parts list, illustrated assembly and wiring sections (Sections 4 to 6) and the Reproduction Guide (Section 12) together with the Configuration Manifest, which is the controlling record of part and file versions.
- The client accepted the system on 15 October 2026. Verification evidence and open items keep their stated scope; see Sections 9 and 13 before relying on any performance figure.

2. System Overview

The EntoSieve reproduction system sorts client-provided bulk insect samples by size, aiming to minimise specimen damage and support repeatable testing. A stepper motor drives a lead screw that moves an arm up and down on a linear rail. The arm carries a sieve bucket, which oscillates through a 30 mm stroke in a water-filled basin. One sieve (3 mm or 10 mm) is fitted for each run, and the operator controls the machine with three push buttons.

2.1 Size Bands

Size is defined as the largest of a specimen's length, width and height ($d = \max(L, W, H)$). The system sorts specimens into three size groups:

- Lower band: 3 mm or smaller ($d \leq 3$ mm)
- Middle band: larger than 3 mm and smaller than 10 mm ($3 \text{ mm} < d < 10$ mm)
- Upper band: 10 mm or larger ($d \geq 10$ mm)

These are intended size bands, not a validated classification guarantee. Operational fraction labels in Section 8 use the sieve that material passed or was retained by. Orientation and specimen condition can change passage.

3. Safety and Laboratory Procedures

3.1 Ethanol and specimen exposure

Classification begins the moment a specimen or batch leaves ethanol; the exposure clock starts at that instant. Every transfer between ethanol and water or another holding condition must be recorded. A temporary return to ethanol does not reset the accumulated total. The cumulative time outside ethanol must not exceed 4 hours for any batch.

Ethanol is flammable. Keep ethanol containers away from the controller box, the power adapter and the wall socket.

3.2 Laboratory access and authorised procedures

Before each session, confirm four things:

- Laboratory access is arranged.
- The authorised sample-handling procedure is available and being followed.
- A named operator is assigned.
- Everyone handling samples or working at the machine wears a laboratory coat and safety goggles.

Record the session readiness check, the operator and any problems in the session record.

3.3 Stopping the machine

The three operating buttons request controlled motion and stopping. They are not an emergency power disconnect. Keep hands and loose items clear of moving parts.

During oscillation, press C to request a controlled stop. During manual positioning, release the held direction button or press C. Pressing A and B together also requests a stop.

After a stop, let go of all buttons before pressing again. The machine ignores a button that is still held down.

Stop and isolate power (Section 3.4) before hands-on sieve replacement, wiring work or mechanical adjustment.

The current configuration has no automatic homing, no independent end-of-travel switches and no automatic over-travel protection. The operator must establish the starting position and check available travel before starting oscillation.

3.4 Electrical Safety

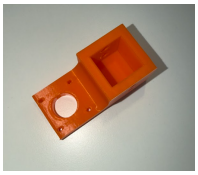
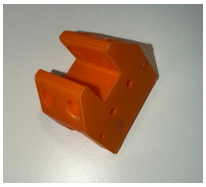
The only mains-voltage part of the system is the AC/DC converter (power adapter), which plugs into a 230 V wall socket and supplies 12 V DC, rated 3 A. Everything on the machine runs on 12 V DC from the converter and 5 V from the Arduino's USB cable. These voltages are low, but the supply can deliver several amps, so a short circuit can still overheat wires or burn components, and the A4988 driver and motor become warm in normal use. Keep the converter, wall socket and any power board on the dry side of the bench, away from the basin, splashes and ethanol. Never touch plugs, connectors or the controller with wet hands. Close the controller lid before wet operation, and stop and dry everything if water reaches the electronics (Section 10).

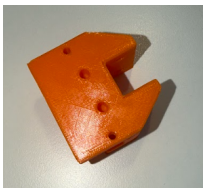
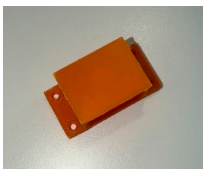
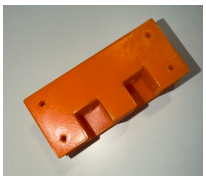
Disconnect the external 12 V adapter from mains before changing motor or supply wiring. Do not connect or disconnect the motor while the A4988 is powered. Connect the wiring and USB logic supply before energising the 12 V adapter. Keep motor power disconnected during firmware upload or reset because D13 can toggle during boot. For shutdown, remove adapter power, then disconnect USB if isolating all electronics. The operating buttons provide a software stop; they do not isolate power.

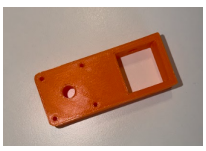
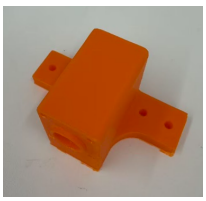
4. Bill of Materials and Sourcing

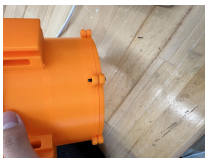
Use the current Configuration Manifest and reproduction table to select parts for another unit (Decision D41). Historical rows below explain the original assembly; they are not current purchase requirements. Supplier prices were checked on 16 October 2026 and can change. RS prices exclude GST; retail prices include GST.

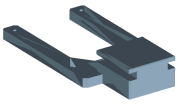
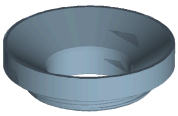
4.1 3D printed components

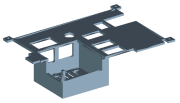
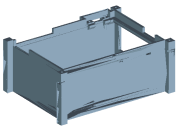
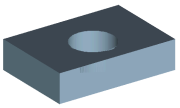
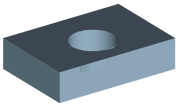
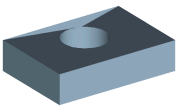
Part	Qty	Est. filament (g)	Est. print time	Image
Electronics housing (historical)	1	48	1h35	
Electronics housing lid (historical)	1	14	0h40	
Spacer Controlbox (historical)	1	40	1h50	
Motor Bracket GitHub STL · Saved PETG job	1	37	1h00	
Bucket Carrier (v3) GitHub STL · Print project Both carrier pieces together; one estimate shared across these two rows.	1	61.72 g / pair	2 h 52 m 33 s / pair	

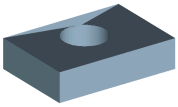
Part	Qty	Est. filament (g)	Est. print time	Image
Bucket Carrier, mirrored (v3) GitHub STL · Print project Both carrier pieces together; one estimate shared across these two rows.	1	61.72 g / pair	2 h 52 m 33 s / pair	
Thread Nut Bracket GitHub STL · Grouped Print project: object 5	1	14	0h28	
Bucket Clip Bracket GitHub STL · Grouped Print project: object 2	1	61	1h28	
Endstop Low Holder (historical)	1	10	0h24	
Trigger Endstop (historical)	1	21	0h33	
Clip 20x20 Adapter GitHub STL · Grouped Print project: object 4	1	11	0h22	

Part	Qty	Est. filament (g)	Est. print time	Image
Clip Cover GitHub STL · Grouped Print project: object 3	1	43	1h10	
Sieve Bucket (original glued design, superseded)	2	163	3h30	
Flip Clip GitHub STL · Grouped Print project: object 3	2	27	0h54	
Bearing Holder GitHub STL · Saved PETG job	1	24	0h40	
Grease Cover GitHub STL · Grouped Print project: object 4	1	60	1h14	
One Piece Closure	1	Not recorded	Not recorded	

Part	Qty	Est. filament (g)	Est. print time	Image
Sieve Retaining Ring (B02) GitHub STL · Slice settings Candidate slicing estimate	1	19.27 g	1h 0m 16s	
Lightweight bucket, screw-fastened (B01) – current GitHub STL · Slice settings Candidate slicing estimate	1	261.96 g	12h 29m 11s	 12 October photograph
Flat sieve, 3 mm (B05) GitHub STL · Print project Slicing estimate ZIP report: FLAT-03	1	25.95 g	2h 50m 41s	 12 October photograph
Flat sieve, 10 mm (B05) GitHub STL · Print project Slicing estimate ZIP report: FLAT-10	1	22.09 g	1h 31m 32s	 12 October photograph
Curved sieve, 3 mm (BS03, v0.2) GitHub STL · Print project · Settings · Slice settings Slicing estimate	1	121.54 g	18h 26m 18s	 STL model

Part	Qty	Est. filament (g)	Est. print time	Image
Curved sieve, 10 mm (BS10, v0.2) GitHub STL · Print project · Settings · Slice settings Slicing estimate	1	106.10 g	15h 12m 26s	
Reinforced offset support (BR02, v0.3) GitHub STL · Print project · Settings · Slice settings Slicing estimate	1	44.53 g	2h 13m 35s	 STL model
Q01 basin outlet connector GitHub STL · Print project · Settings · Slice settings Slicing estimate	1	79.81 g	4h 31m 27s	 STL model
Filter holder threaded ring GitHub STL · Grouped Print project: object 2	1	Not recorded	Not recorded	 STL model
Bowl stand 2 for draining GitHub STL · Saved PLA job	1	Not recorded	Not recorded	 STL model

Part	Qty	Est. filament (g)	Est. print time	Image
U02 lid and fan mount GitHub STL · Print project · Settings · Slice settings Slicing estimate	1	169.58 g	6h 43m 37s	 STL model
B01 controller body, 60 mm GitHub STL · Print project · Settings · Slice settings Slicing estimate	1	234.74 g	11h 31m 33s	 STL model
PCB front clamp A GitHub STL	1	Not recorded	Not recorded	 STL model
PCB front clamp B GitHub STL	1	Not recorded	Not recorded	 STL model
PCB rear clamp A (S09) GitHub STL Slicing estimate ZIP report: S09	1	0.23 g	1m 40s	 STL model

Part	Qty	Est. filament (g)	Est. print time	Image
PCB rear clamp B (S10) GitHub STL Slicing estimate ZIP report: S10	1	0.23 g	1m 39s	 STL model

*Estimate basis: saved slicer values are predictions for the linked profile, including generated supports, skirt or brim; they are not measured consumption or elapsed printing time. The two carrier rows share one paired-job estimate. B01 bucket and B02 ring values are review-only candidate estimates. Remaining original-list estimates retain their historical basis; "Not recorded" means no attributable per-part slicing result. Values marked * are CAD solid-mass references, not filament predictions.*

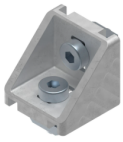
Bucket options. Two current sieve arrangements exist. (1) The lightweight bucket (B01) holds an interchangeable flat sieve under the retaining ring (B02), secured with six screws. (2) The curved sieves (BS03 or BS10) fit to the arm through the reinforced offset support (BR02). Both flat sieves were used on 11 October, and each curved sieve passed two ten-minute submerged water runs on the same day. The original glued Sieve Bucket is kept only as history.

The original housing, lid and Spacer Controlbox are historical. The current enclosure uses the integrated B01 body, retained PCB clamps and U02 one-piece upper assembly. It stands separately from the machine, away from the wet area; no frame attachment or Spacer Controlbox is required. Endstop-related parts describe the first assembly; no independent end-of-travel switches operate in the current controls. Use the Manifest for current source selection.

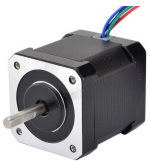
GitHub links open the corresponding released file. Access requires an authorised GitHub account. Saved print recipes retain their documented scope; the original Drive evidence remains linked.

4.2 Structural (Bosch Rexroth extrusion + fasteners)

Part	Qty	Price (AUD)	Image	Notes
Rexroth 30x30x500 profile	1	$57.01 per 1 m length		RS Components RS 493-8252 Bosch Rexroth 30×30, 8 mm groove (3842990720/1000). Cut to 500 mm. Two 1 m lengths cover all 30×30 pieces (500 + 120 + 2×30 + 2×200 = 1080 mm).

Part	Qty	Price (AUD)	Image	Notes
Rexroth 30x30x120 profile	1	Cut from 30×30 stock		Cut to 120 mm from the same 1 m lengths.
Rexroth 30x30x30 profile	2	Cut from 30×30 stock		Cut to 30 mm.
Rexroth 30x30x200 profile	2	Cut from 30×30 stock		Cut to 200 mm. Lower-cost option: RS PRO 30×30 1 m, RS 264-7862 ($25.22). Check its groove fits the Rexroth T-nuts and brackets.
Rexroth 30x30 gusset set	8	$22.57 each		RS Components RS 523-364 Bosch Rexroth angle bracket for 30 mm profile, groove 8 (3842551598), supplied with fasteners. The first build used one per side at the main joint (Step 10).
Rexroth 20x20x200 profile	4	$50.36 per 1 m length		RS Components RS 212-3292 Bosch Rexroth 20×20, 6 mm groove (R987501074). Cut four 200 mm pieces from one 1 m length.
Rexroth T-nut	51	$75.25 per bag of 10 (groove 8); $35.05 per bag of 10 (groove 6)		The current reproduction schedule uses 51 T-nuts: 24 M4, 11 M5 and 16 M6. Match each thread and groove to the recorded joint. The original quantity of 20 is historical. No controller-to-frame T-nuts are required because the controller stands separately.

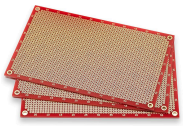
4.3 Motion / linear components

Part	Qty	Price (AUD)	Image	Notes
Threaded rod 8x10, 450mm	1	Quote		igus Australia: dryspin high-helix lead screw Part DST-LS-8X10-R-ES (8 mm, 10 mm lead, stainless). Order cut to 450 mm. Price on request: au-sales@igus.net, 1300 726 244.
Shaft nut	1	Quote		igus Australia: dryspin JFRM flange nut Part DST-JFRM-202020DS8X10, to match the lead screw.
Linear rail, 410mm	1	$122.13 (600 mm)		RS Components RS 747-2691 igus WSQ-06-30-600 drylin W rail. Cut to 410 mm, or order cut-to-length from igus.
Linear carriage	1	Quote		igus Australia: drylin WWQ-SL carriage Part WW-06-30-06-SL.
Stepper motor (NEMA 17)	1	$24.95		Jaycar YM2756 Installed: SY42STH47-1684A, 1.68 A/phase. A replacement must be a 4-wire bipolar NEMA 17, 1.8° (200 full steps/revolution), with compatible mounting and 5 mm shaft. With the 10 mm lead and half-step mode, calibration is 40 steps/mm. Check coil pairs, current limit, direction, measured stroke and loaded motion after replacement.

Part	Qty	Price (AUD)	Image	Notes
Coupling, motor-rod	1	$10.45		Core Electronics ADA1176 5 mm (motor) to 8 mm (lead screw) flexible coupling.
Bearing 608-2RS	2	$5.99 each		RS Components RS 618-9957 RS PRO 608-2RS, 8 × 22 × 7 mm. One goes in the Bearing Holder and one in the Motor Bracket (Steps 12–13).

4.4 Electronics

Part	Qty	Price (AUD)	Image	Notes
Arduino Nano	1	$45.66		Core Electronics Arduino Nano A000005 ATmega328. Also needs a USB cable to suit the Nano's USB socket.
Stepper motor driver	1	$13.90		Core Electronics Pololu A4988 #1182 Installed: red RepRap-style A4988 with R100 sense resistors; recalculate VREF for a replacement. For the listed Pololu #1182, fit ≥47 µF electrolytic decoupling close to VMOT/GND, positive to VMOT, rated above the supply voltage. This replacement guidance does not establish the installed capacitor arrangement. Pololu power connections
Fan	1	$19.95		Jaycar YX2503 12 V DC, 40 × 40 × 10 mm thin fan.

Part	Qty	Price (AUD)	Image	Notes
AC/DC converter (12 V DC, 3 A)	1	$32.50		Bourne Electronics Powertran M8937D The installed unit (label CW42F1203000AC) was bought from Altronics. 12 V DC, 3 A, 2.1 mm plug, centre positive.
DC connector	1	$4.95		Jaycar PA3713 2.1 mm DC socket with screw terminals, to suit the converter plug (as installed).
Historical switch option	0	$2.95		Original supplier option only. Not a confirmed installed component or a current reproduction requirement. Isolate motor power at the external adapter.
Historical DC switch option	0	$6.95		Original supplier option only. Not a confirmed installed component or a current reproduction requirement. Isolate motor power at the external adapter.
Separate red and green LEDs	2	Not priced	Separate LEDs required	Excluded candidate: Jaycar ZD0250 Use one red and one green LED, each with a 220 Ω resistor. The two-lead inverse-parallel ZD0250 is incompatible with this two-output, common-ground wiring. ZD0250 datasheet
Replacement board candidate	1	$5.95		Jaycar HP9550, 95 × 72 mm, is a supplier candidate only. The retained controller board is approximately 160 × 100 mm. Verify layout and clamp fit before any substitution; this is not a direct replacement.
Push buttons (A, B, C)	3	$2.00 each		Jaycar SP0710

Part	Qty	Price (AUD)	Image	Notes
				Momentary push buttons. The current build has no end switches (Decision D46); these three buttons are the only operator inputs.
220 Ω resistors	2	$0.85 per 8		Jaycar RR0556 One in series with each LED colour.

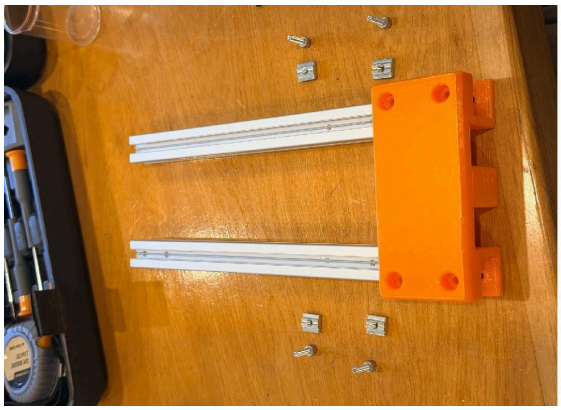
The installed board also carries two potentiometers. The current firmware does not use them, so they can be left out of a new build (Decision D50).

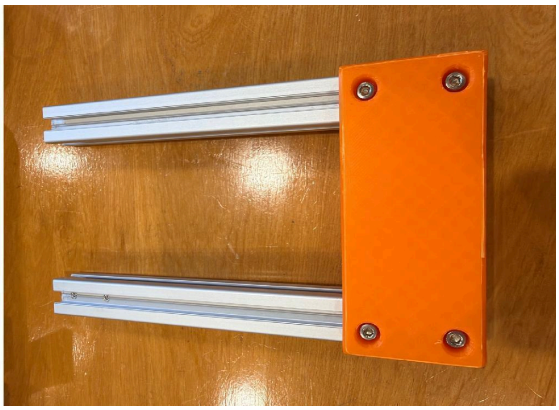
5. Build and Assembly Instructions

These steps follow the first mechanical assembly (September 2026), with current changes noted. Fit washers at exposed nut-to-print contacts, but not inside captive nut recesses. Retain specified head washers. The 20×20 profiles use groove-6 T-nuts; the 30×30 profiles use groove-8 T-nuts.

Step 1. Attach the first pair of aluminium profiles to the Bucket Clip Bracket

Position two 20×20×200 mm profiles against one side of the Bucket Clip Bracket. Insert four T-nuts into the profile slots, align with the bracket's mounting holes, and secure with four matching screws.

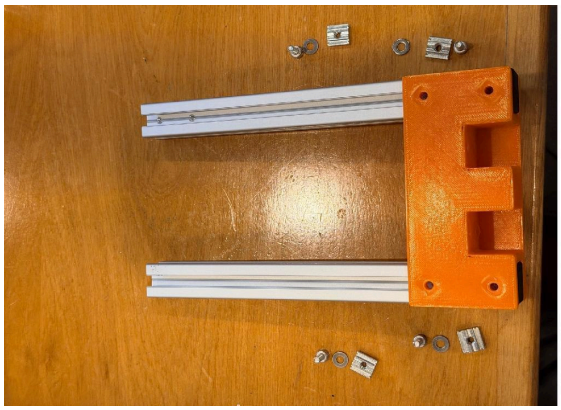


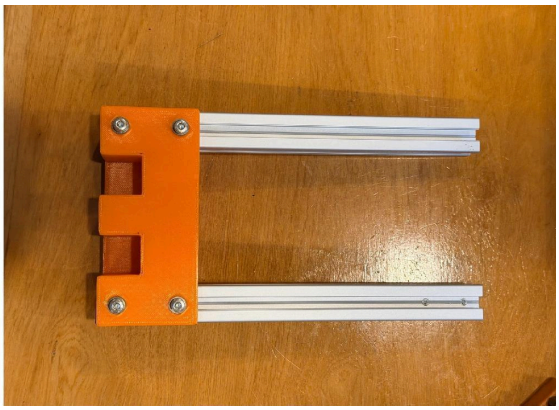


Step 2. Secure the opposite face of the Bucket Clip Bracket

Turn the Step 1 subassembly over, align the four remaining mounting points, place a washer beneath each screw head, and secure with four T-nuts and screws.

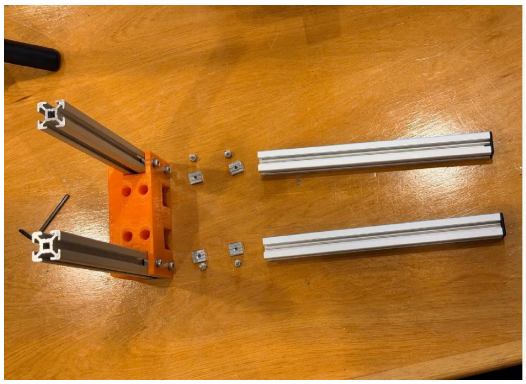
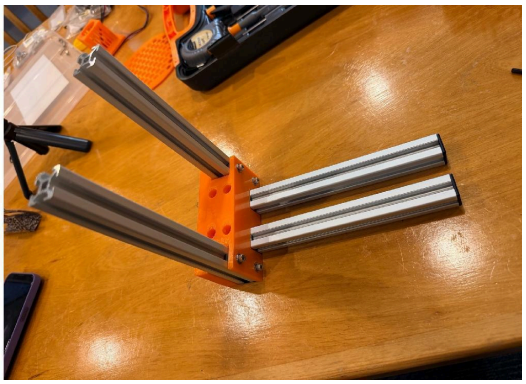
Confirmed clip-bracket hardware: 7 mm wall, four M4 × 12 mm; 5 mm wall, four M4 × 10 mm; recessed wall, four M4 × 10 mm countersunk screws without head washers. Identify each wall before selecting its screws. Jianchen, Ruohan and Zhishuai confirmed the recorded specifications during assembly; the record was closed on 18 October 2026.





Step 3. Attach the second pair of aluminium profiles

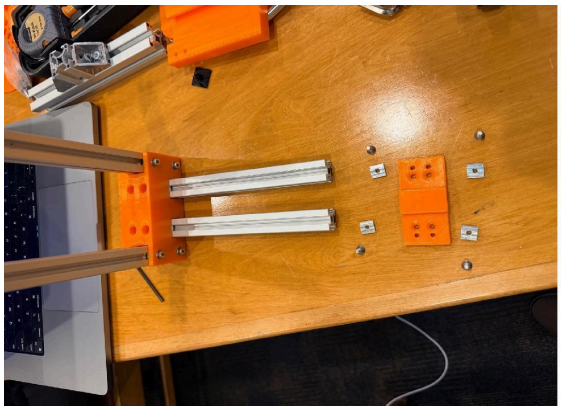
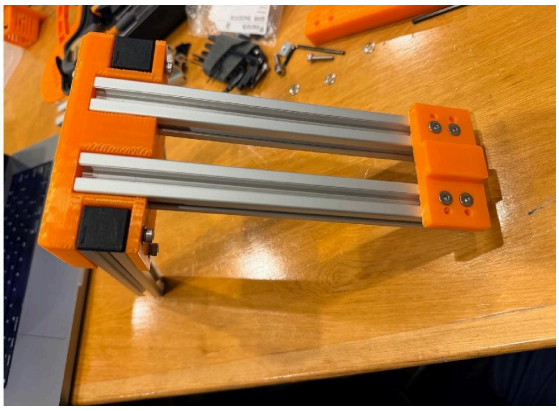
Position the remaining two profiles on the opposite side of the bracket, insert four T-nuts, align, and tighten four screws to complete the four-profile support frame.

Step 4. Install the Clip 20×20 Adapter

Position the adapter across the free ends of the two profiles from Step 3, confirm orientation, align the holes, and secure with four M4 × 12 mm countersunk screws and four T-nuts.

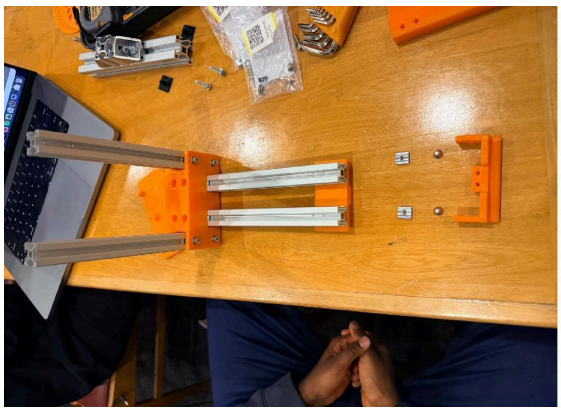
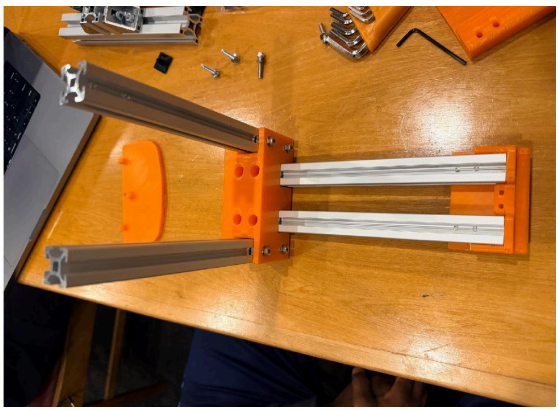
Assembly note: Installation direction matters. Countersunk screws are required because the printed part has recessed mounting holes.

Step 5. Install the Endstop Low Holder

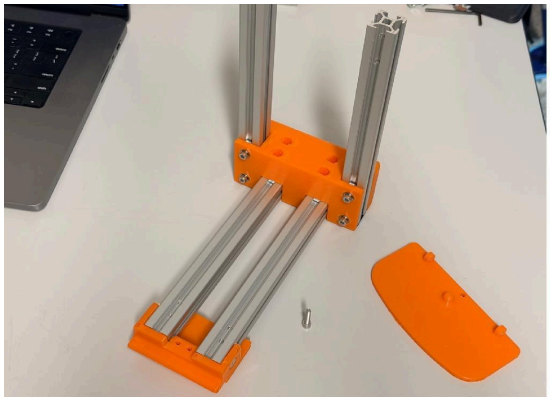
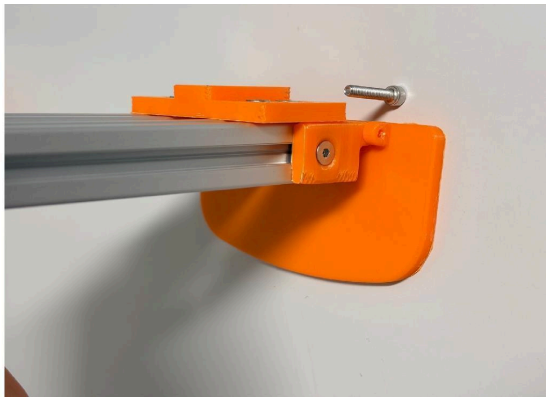
Position the holder at the end of the relevant profile pair, insert two T-nuts, align, and secure with two countersunk screws.

Assembly note: Orientation was confirmed using the EntoSieve demonstration video. Countersunk screws suit the recessed holes. The endstop switch function is not used in the current build (Decision D46).

Step 6. Connect the Trigger Endstop

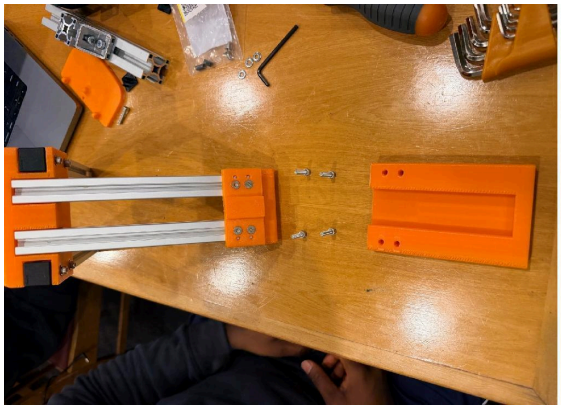
Align the mounting hole in the Trigger Endstop with the corresponding hole in the Endstop Low Holder, insert the fastening bolt, and secure.

Step 7. Attach the Clip Cover

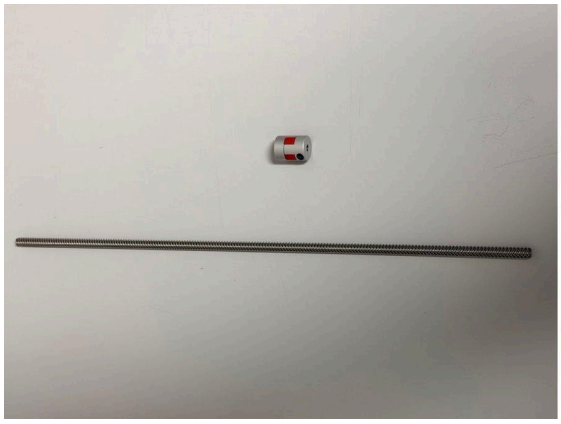
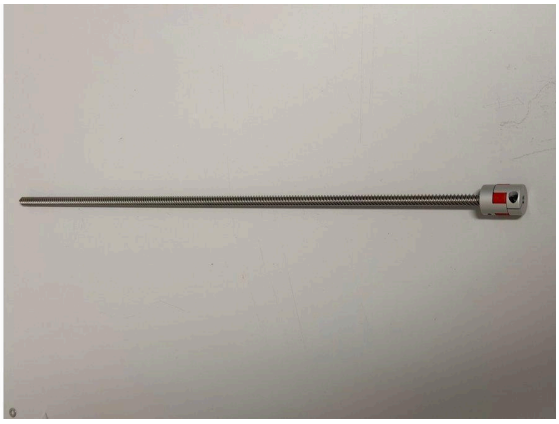
Position the Clip Cover against the adapter and secure its four mounting holes with four M4 × 30 mm screws and four rear nuts. Use washers at exposed nut-to-print contacts. The two removable Flip Clips are separate changeover accessories; they are normally not fitted during operation.

Assembly note: Do not over-tighten into the printed parts. Retention and attachment checks passed on the built unit (UT-MECH-07).



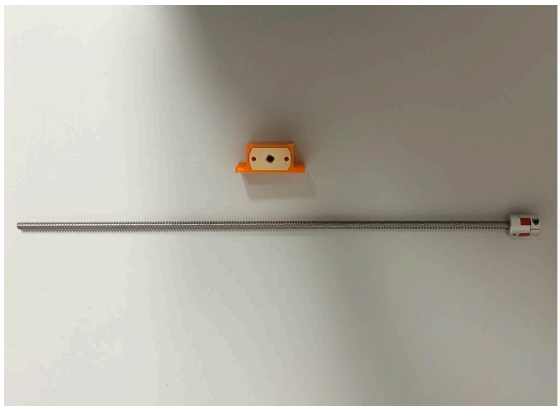
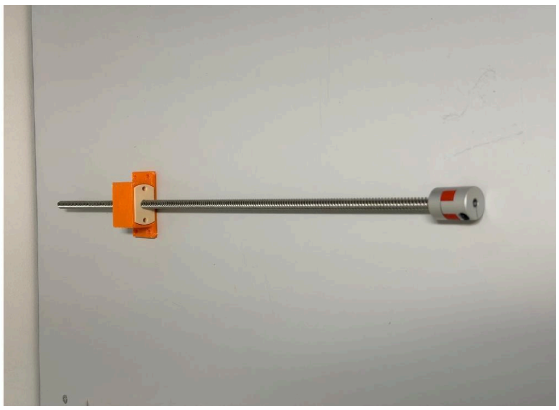

Step 8. Connect the motor-to-rod coupling to the threaded rod

Insert one end of the 450 mm threaded rod into the motor-to-rod coupling. Align the rod in the coupling and tighten the coupling's clamping screws.

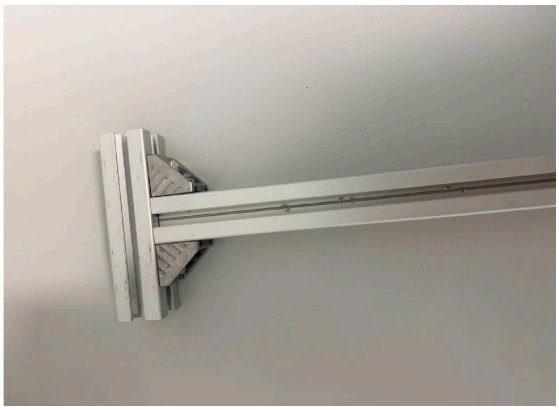
Step 9. Install the Shaft Nut and Thread Nut Bracket

Seat the Shaft Nut in the Thread Nut Bracket and align the central bore. Turn the Step 8 threaded-rod subassembly through the nut until the bracket and nut are positioned as shown, confirming the threads engage smoothly without cross-threading.

Step 10. Assemble the main aluminium-profile frame joint

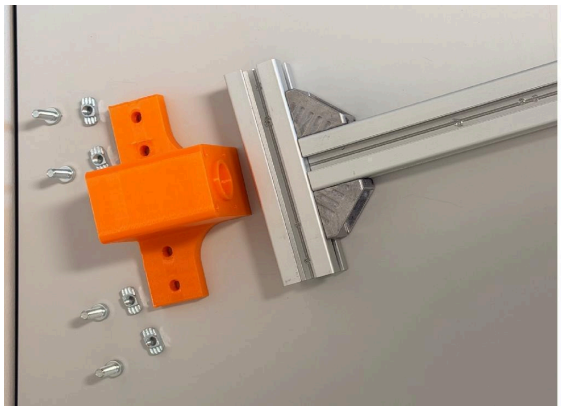
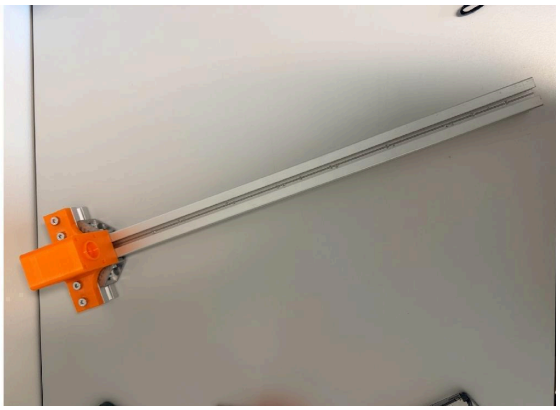
Join the 30×30×120 mm base to the 30×30×500 mm upright using two gussets, four M6 × 14 mm screws and four groove-8 M6 T-nuts. Keep the joint square.

Step 11. Attach the Grease Cover

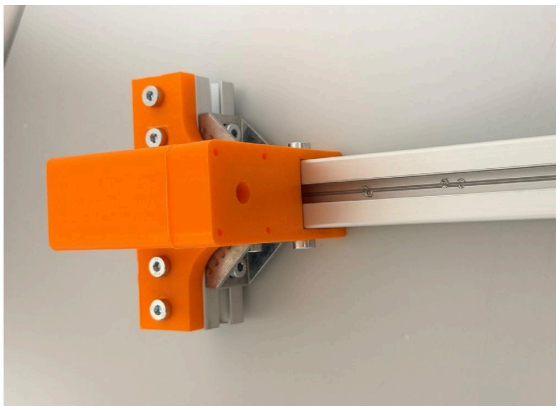
Position the Grease Cover on the Step 10 frame and secure with four M5 × 20 mm screws, four head washers and four groove-8 M5 T-nuts. Tighten evenly without crushing the printed ears.

Assembly note: Washers were missing in the first build and were fitted later. Direct bolt loading may damage the printed part.

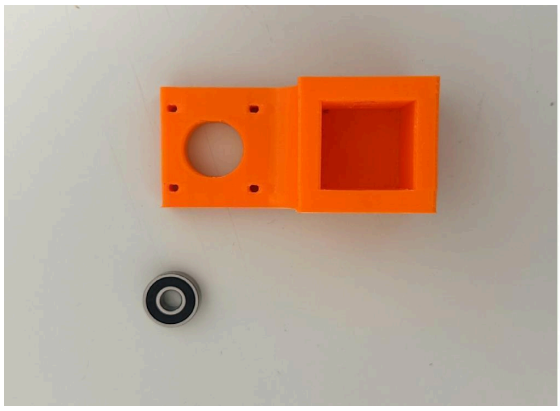
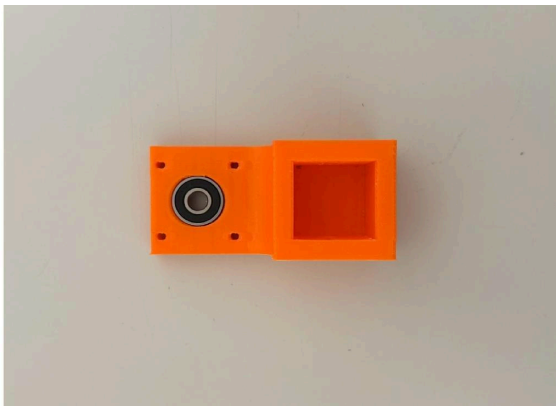
Step 12. Install the bearing and Bearing Holder

Press a 608-2RS bearing fully into the Bearing Holder recess. Align the holder on the Step 11 frame and secure with two M5 × 12 mm screws and two T-nuts.

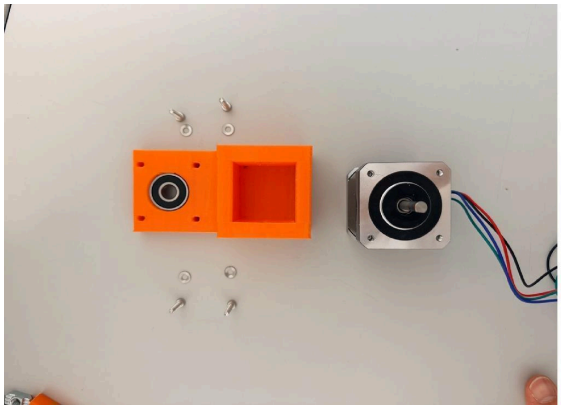
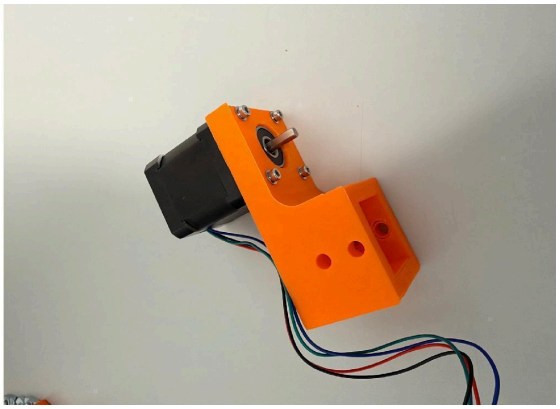
Step 13. Insert the bearing into the Motor Bracket

Align the second 608-2RS bearing with the circular recess in the Motor Bracket and press it in until fully seated and flush.

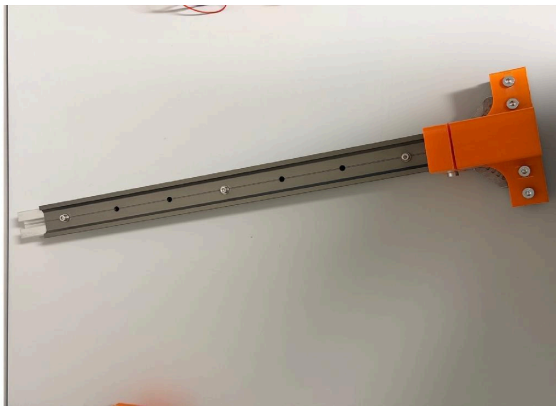
Step 14. Attach the stepper motor to the Motor Bracket

Align the NEMA 17 motor with the bracket and guide the shaft through the bearing. Secure with four M3 × 16 mm screws and four head washers, tightened diagonally.

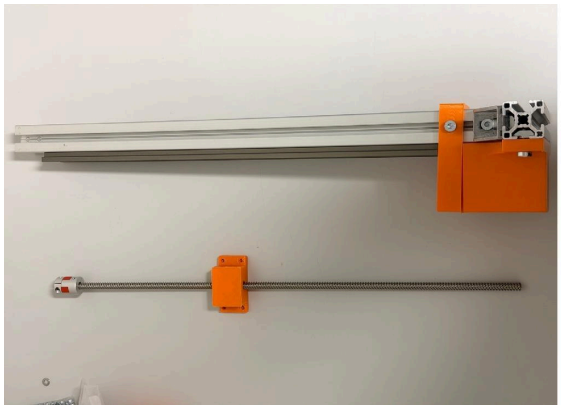
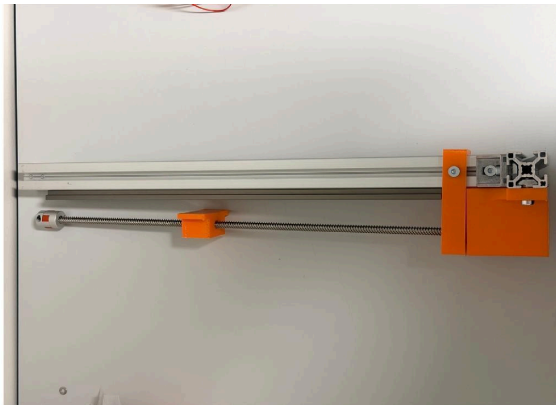
Step 15. Install the linear rail

Secure the 410 mm rail to the main profile using three M5 × 12 mm screws, head washers and three groove-8 M5 T-nuts. Keep it straight and parallel to travel.

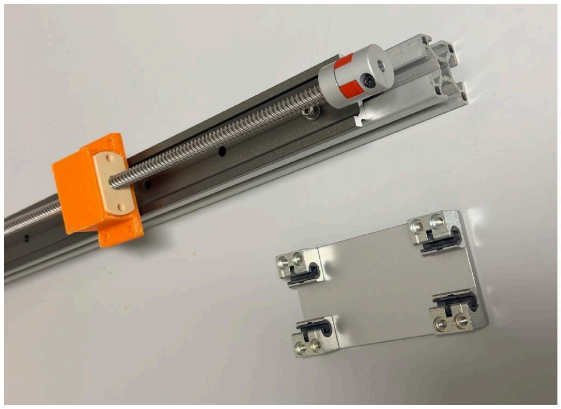
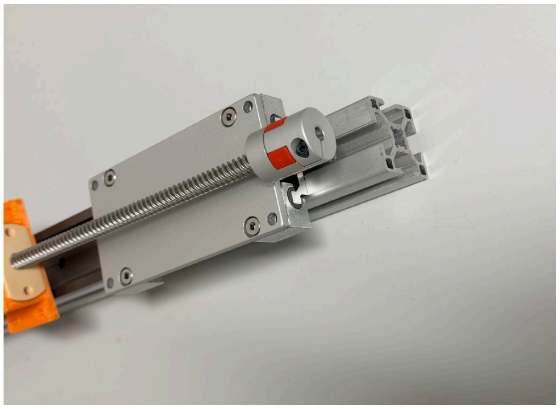
Step 16. Insert the threaded rod into the Bearing Holder

Align the free end of the Step 9 threaded-rod subassembly with the bearing on the Step 15 frame and insert it, confirming it is supported without binding.

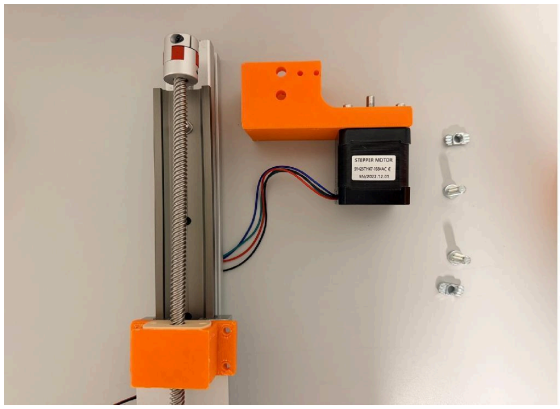
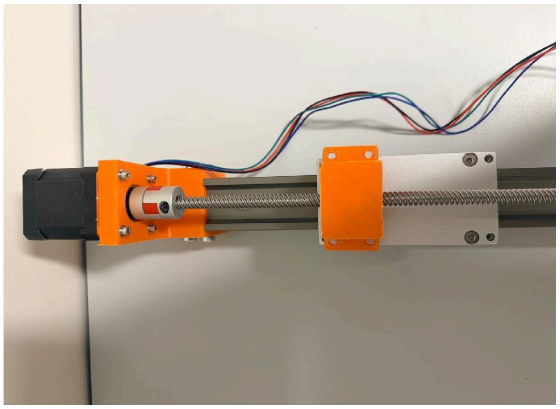
Step 17. Install the linear carriage

Align the carriage with the open end of the rail, slide it on in the correct orientation, and move it slowly to confirm smooth travel without binding or excessive play.

Step 18. Install the motor assembly and connect the coupling

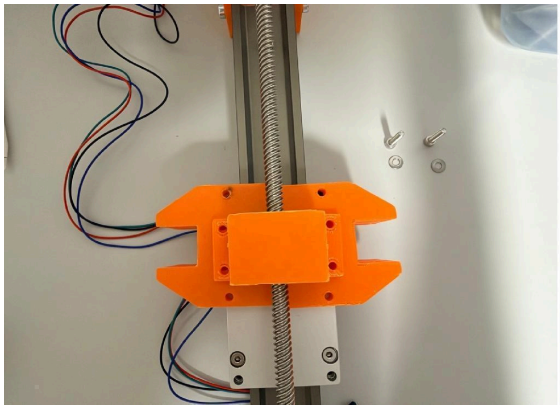
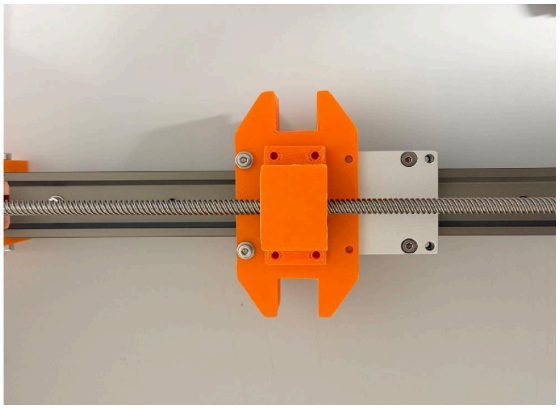
Secure the Step 14 motor-and-bracket subassembly to the main profile with two M5 × 16 mm screws and two T-nuts. Insert the motor shaft into the coupling, align it with the threaded rod, and tighten the coupling clamps.

Step 19. Attach the Bucket Carrier components to the linear carriage

Position the Bucket Carrier and mirrored Bucket Carrier on the metal linear carriage. Secure the outer mounting ears with four M4 × 16 mm screws and four head washers, tightening evenly. These fasteners enter the metal carriage threads; they are separate from the carrier-to-profile screws in Step 21.

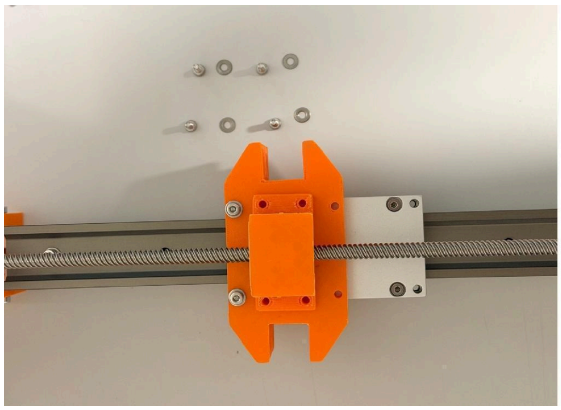
Assembly note: Use the v3 carriers (enlarged captive-nut relief). Earlier carrier versions had nut-fit problems.

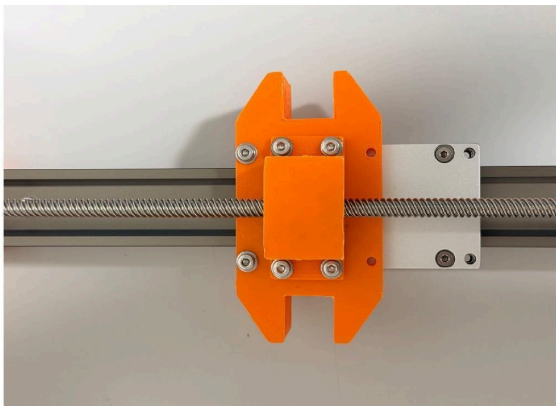



Step 20. Connect the Thread Nut Bracket to the Bucket Carrier assembly

Align the Thread Nut Bracket with both carrier parts and secure with four M4 × 10 mm screws and four head washers. Check that the bracket stays centred on the threaded rod and does not restrict motion. Assembly-day confirmation was entered in this record on 18 October 2026.

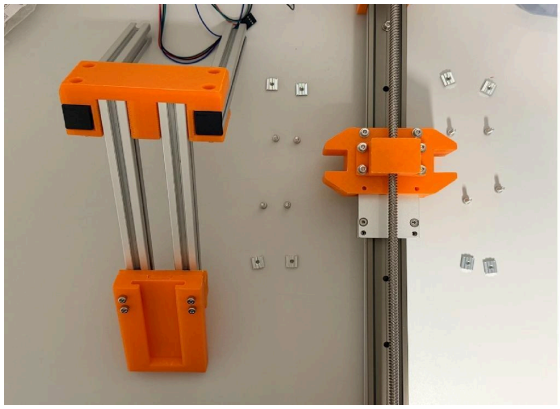
Assembly note: The first build questioned the strength of this bolted joint. With the v3 carriers, retention stayed secure through full travel in clean-water operation (4 October) and three attachment cycles were accepted.

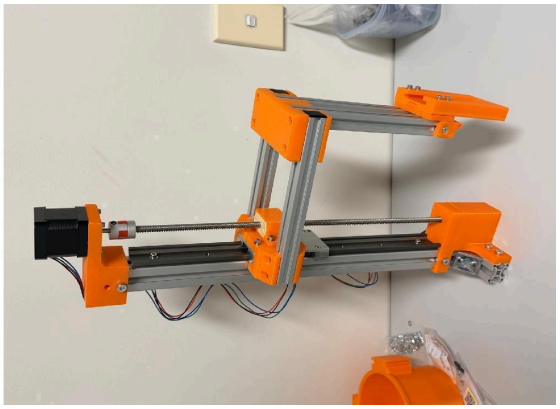




Step 21. Connect the sieve-holder frame to the Bucket Carrier assembly

Position the four profiles from Step 7 in the carrier mounting locations. Secure both carrier-to-profile joints with eight M4 × 10 mm screws and eight T-nuts in total. Tighten alternately and check that the frame stays square. Count this shared hardware once.

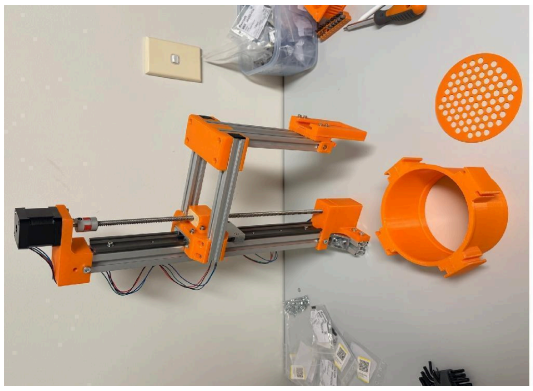


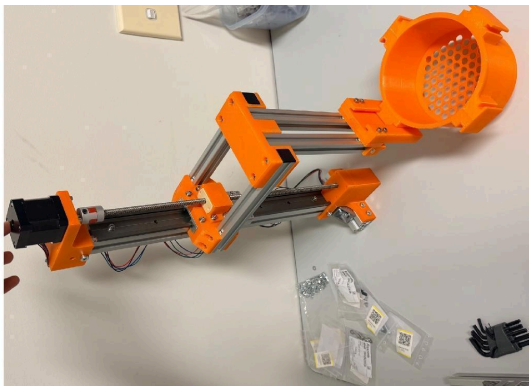


Step 22. Install and secure the sieve bucket

First build (shown): the 10 mm mesh sieve was placed in the original Sieve Bucket, the bucket was positioned in the Step 21 holder, and the Flip Clip and bucket latch were engaged.

Fit the flat sieve into the lightweight bucket (B01), add the retaining ring (B02), and secure with six M3 × 20 mm screws; 16–20 mm is usable. Secure the bucket to its holder with two M3 × 25 mm screw-and-nut pairs; 25–30 mm is usable. Use washers at exposed nut-to-print contacts, but not inside captive recesses. Check for firm retention without wobble. For the curved sieve, see Section 7.1, Step 2.





5.1 Basin fabrication and outlet assembly

The basin uses the larger 3.7 L IKEA VISPAD polypropylene bowl, nominally 26 cm in diameter, with the adopted Q01 outlet connector. Q01 has a smooth internal slope while retaining the exterior and lower filter interface.

Use one PART-07 threaded ring to retain the metal filter basket and one bowl stand 2 when placing the basin for drainage. The former sieve mount, sieve outlet, outlet lid and first bowl stand are not used.

Q01, draining stand and filter-ring configuration

The six photographs below preserve the original fabrication process. They show the earlier connector, not evidence that its stepped interior remains installed. Select Q01 from the linked configuration record for reproduction.

Tools and consumables: marking pen, cordless drill and suitable bit, clamps and workbench, progressively finer sandpaper, super glue and hot-melt adhesive. For another build, select compatible products and follow their surface-preparation and curing instructions.

Basin step 1 Position and mark

Invert and restrain the bowl. Position the connector against the outside of the base and mark the required opening. Check its location and the remaining overlap before removing material.



Process photo 1 — connector positioned for marking.

Basin step 2 Form the opening

The team drilled closely spaced holes just inside the marked boundary, leaving small bridges of plastic. Keep the bowl restrained and inspect for cracking or distortion while forming the opening.





Process photos 2 and 3 — drill setup and perforated outline.

Basin step 3 Finish the edge

Remove the waste section, deburr the opening and sand from coarser to finer grit. Clear loose debris and check the connector seats evenly before bonding. Select the finished opening from the actual mating part; the photograph is not a dimensional tolerance.



Process photo 4 — opening after removal and sanding.

Basin step 4 Bond the connector

The recorded build used super glue between the connector and the exterior bowl surface. Check alignment and coverage around the interface. For reproduction, follow the selected adhesive instructions for polypropylene and the actual printed material.

Basin step 5 Seal and inspect

The team then applied hot-melt adhesive around the joint. After curing and cooling, inspect for gaps, movement and obstruction of the outlet. Recheck water containment after rework; sealing does not establish a rated structural bond strength.



Process photos 5 and 6 — initial bond and completed sealing stage.

Recorded result: on 12 October, three static leak holds passed without leakage at 10:30.68, 10:33.75 and 11:04.05. Qualitative drainage passed without problematic pooling. These results apply to the tested assembly, not long-term adhesive durability.

12 October water results and photographs

Source: the original Inner Container Assembly Report, Section 4, contains the five-step narrative and Figures 3–8; Section 8 records the later verification update. The original report is retained as history.

Original assembly narrative and process photographs

6. Electrical and Control System

This section explains how the controller is powered and wired in the current three-button build, which runs firmware ENTOSIEVE_CLICKSPEED_20261012. There are no limit switches and no automatic homing (Decision D46), so the operator sets the position by hand. Use Section 6.2 for wiring order and Section 6.3 for the pin-by-pin tables.

6.1 Main Components

- **Arduino Nano** – the controller, powered over USB.
- **A4988 driver board** – turns the Nano's STEP and DIR signals into motor current. The installed board has 0.10 Ω (R100) sense resistors.
- **NEMA 17 stepper motor** (installed: SY42STH47-1684A, 1.68 A/phase) – turns the lead screw.
- **Three push buttons A, B, C** – manual positioning, speed change, start and stop.
- **Red and green LEDs** – status indicators, each with a 220 Ω resistor.
- **12 V, 40 mm fan** – cools the controller box. It runs whenever the 12 V supply is on.
- **12 V 3 A AC/DC converter** (Powertran M8937D, label CW42F1203000AC) – powers the motor driver and fan, separate from USB. There is no DC–DC converter on the board.
- **Two potentiometers** – still fitted on the installed board but not used by the firmware. They can be left out of a new build (Decision D50).

6.2 Step by step (build order)

1. Power everything off before wiring anything.
2. Identify the motor's coil pairs with a multimeter. Two wires from the same coil read a low resistance, and wires from different coils read open. Don't rely on wire colour.
3. Wire the Nano to the A4988: D13 to STEP, D12 to DIR, Nano 5 V to VDD and Nano GND to logic GND. Link SLEEP and RESET together and connect them to Nano 5 V. Connect ENABLE to GND. Set MS1 to 5 V and MS2 and MS3 to GND, as on the installed unit. The firmware assumes 40 steps/mm with this setting.
4. Connect one coil pair to 1A/1B and the other to 2A/2B, using the pairs from Step 2. On the installed unit, blue is 1A, red is 1B, green is 2A and black is 2B. If the carriage later moves the wrong way (A moves down), power off and swap the two wires of one coil.
5. Set the A4988 current limit before connecting motor power. With only USB power on, measure VREF between the driver's trimmer and GND. The installed unit uses VREF = 1.28 V, which with 0.10 Ω sense resistors gives a limit of 1.28 / (8 × 0.10) = 1.60 A, just below the motor's 1.68 A rating. On a board with different sense resistors, use VREF = current limit × 8 × Rsense. Record the value you set.
6. With the adapter disconnected from mains, connect the centre-positive 12 V input to A4988 VMOT and fan positive. Join supply negative, A4988 GND, fan negative and Nano GND. Check polarity. For a replacement driver, follow the near-board capacitor guidance in Section 4.4. Keep motor power disconnected for upload and reset.
7. Wire the three operating buttons: A to D2, B to D3 and C to D4, each between its pin and GND. The firmware uses the Nano's internal pull-ups.

8. Wire the red LED from D8 and the green LED from D9, each through a 220 Ω resistor, to GND.
9. With 12 V disconnected, upload ENTOSIEVE_CLICKSPEED_20261012 over USB using the bundled FlexyStepper files. Follow the package recovery sequence in Section 11.4; do not add it as another tab in the old project.
10. Check stopping before samples: release a held A or B during manual motion; press C during oscillation; or press A and B together. During oscillation, releasing a speed-adjustment button does not stop motion.

6.3 Wiring Reference Tables

6.3.1 Nano ↔ A4988 control signals

Nano pin	A4988 pin	Notes
D13	STEP	Step pulse (code: MOTOR_STEP_PIN)
D12	DIR	Direction (code: MOTOR_DIRECTION_PIN)
5V	VDD	Logic supply from the Nano (USB powered)
GND	GND (logic side)	Common ground
5V	SLEEP + RESET	Linked together and tied to 5 V, or the motor will not run
GND	ENABLE	Tied to GND. The firmware does not control ENABLE
5V	MS1	HIGH. Sets the step mode the firmware expects (40 steps/mm)
GND	MS2	LOW
GND	MS3	LOW

6.3.2 Motor coils ↔ A4988

Motor wire colour	A4988 pin	Notes
Blue	1A	Coil 1, one end
Red	1B	Coil 1, other end
Green	2A	Coil 2, one end
Black	2B	Coil 2, other end

Wiring caution: these colours are as reported for the installed SY42STH47-1684A motor. Motor leads have no colour standard, so confirm the coil pairs on any replacement motor with a multimeter. Pairing leads from different coils stops the motor turning correctly.

6.3.3 Power Wiring

From	To	Notes
USB cable	Nano USB socket	Logic power. Nano 5 V then feeds A4988 VDD
12 V (+) from adapter	A4988 VMOT	Motor power from the 12 V 3 A converter

From	To	Notes
12 V (+) from adapter	Fan (+)	Fan in parallel with the driver supply
12 V (-)	A4988 GND (motor side), fan (-), Nano GND	Must share a common ground with the Nano, or STEP/DIR will not be read correctly

6.3.4 Operating buttons

Button	Nano pin	Function
A	D2	Stopped: hold to move up. Oscillating: each press is 5 mm/s faster
B	D3	Stopped: hold to move down. Oscillating: each press is 5 mm/s slower
C	D4	Start oscillation; press again to stop. Also stops manual movement

Each button is wired between its pin and GND. Inputs use the Nano's internal pull-ups, so a pressed button reads LOW.

6.3.5 Indicator LEDs

LED	Nano pin	Notes
Red	D8	Pin → 220 Ω resistor → LED anode; cathode → GND. Red indicates the release-all-buttons interlock after startup or stopping; it is not a fault code.
Green	D9	Pin → 220 Ω resistor → LED anode; cathode → GND. Green indicates manual motion, oscillation or deceleration (STOPPING). It does not prove physical motion or isolation. In READY/IDLE with the interlock clear, both LEDs are off.

6.4 Issues you could face

- No standard motor wire colours: verify the coil pairs with a multimeter, not by assumption.
- Missing a common ground across the Nano, driver and supply causes erratic STEP/DIR behaviour.
- Current limit set wrong: too high overheats the driver, too low skips steps under load. VREF depends on the board's sense resistors.
- Underpowered supply: USB alone cannot drive the motor. Use the 12 V 3 A converter.
- Connecting or disconnecting the motor while the driver is powered can damage the A4988.
- No limit switches or automatic homing: the operator must check the travel before starting.
- Motor power on during firmware upload: D13 can toggle at boot, so keep the 12 V supply off.
- Old limit-switch wiring still connected to D2, D3 or D4 would be read as button presses, so check it is disconnected.

7. Commissioning and Startup Procedure

7.1 Setting up the Machine

Step 1. Mount the robot on the bench

Secure the frame to a stable bench using two table-clamp assemblies: six gussets, twelve M6 × 14 mm screws and twelve groove-8 M6 T-nuts. Place the basin beneath the bucket and check for rocking. Keep the controller separate on a dry surface away from the wet area, with ventilation unobstructed and cables clear of motion.



Step 2. Fit the sieve holder to the arm

Fit the bucket or curved sieve for the first cut to the arm and tighten its screws with a screwdriver (curved sieve shown). Check that it is held firmly and cannot wobble. Fit or change sieves only with the power isolated.

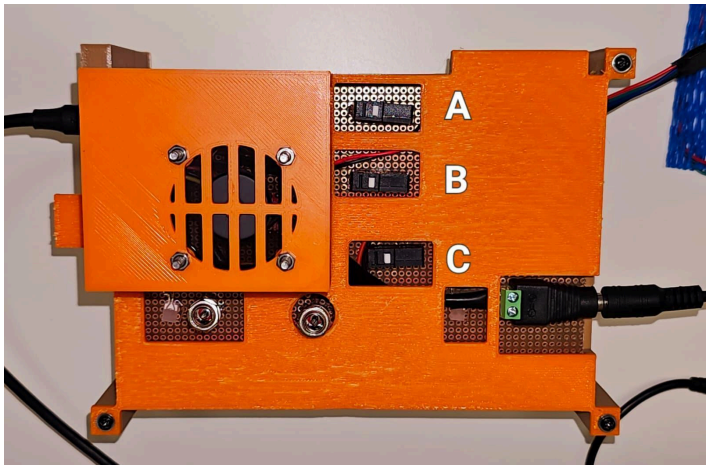






Controller box overview

A, B and C are the operating buttons (Section 6.3.4). The DC socket for the 12 V lead is on the right. The two bare shafts on the lower panel are the retained potentiometers, which do nothing in the current firmware.



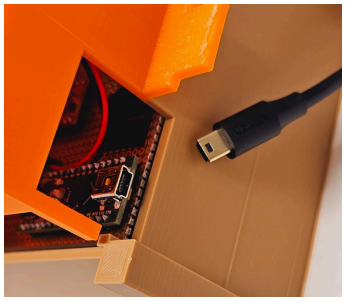
Step 3. Connect the motor cable

With all power off, join the 4-pin motor connector, matching the plug orientation.



Step 4. Connect the USB cable

Connect the USB cable to the Nano. The Nano is powered over USB, so connect the other end to a computer or USB power source and leave it connected while the machine is running.



Step 5. Connect the 12 V DC lead

With the adapter disconnected from mains, connect its 12 V lead to the controller input. Check the connection is secure and dry.



Step 6. Plug in and switch on

Complete the wiring and USB logic connection before connecting the external 12 V adapter to mains. Energise the adapter and keep hands clear while the controller starts.



7.2 Before each session

1. Laboratory access, the sample-handling procedure and the operator are confirmed, and PPE is worn (see 3.2).
2. The machine is clear of hands, tools and loose items.
3. The bucket and sieve are fitted, held firmly and still releasable.
4. Wiring and insulation are intact, with no exposed conductors, and cables are clear of moving parts and the wet area.
5. The basin is in place under the bucket with water at the level used in testing. The external 12 V adapter, wall socket and controller are dry.

No fixed water depth or fill-volume limit was recorded. Set the basin and bucket height for the intended immersion, then check the complete 30 mm motion envelope before loading specimens. Keep adequate containment space and the controller outside the splash area; stop if water escapes. The recorded clean-water runs establish the tested setup only.

6. The external adapter and its mains supply are accessible, so motor power can be removed quickly.

7.3 Starting up

1. Switch on as in Section 7.1, Step 6. Keep hands clear while the controller starts.
2. Position the carriage. Hold A (D2) to move up or B (D3) to move down, at a fixed 15 mm/s. Let go at the middle of the travel you want. There is no automatic homing, so you set the starting position.
3. Check the travel and depth. Oscillation moves 15 mm above and below that point (30 mm in total). Make sure nothing is in the way and that the sieve stays at the intended depth

in the water through the whole stroke. On 6 October the height had to be corrected after the first strokes, so watch the first few cycles.

4. Press C (D4) to start oscillation at 50 mm/s.
5. To change speed while it runs, press A for 5 mm/s faster or B for 5 mm/s slower, within 10–75 mm/s. One press makes one change. Release and press again to change it again.
6. To stop, press C. The machine keeps your speed and centre.

7.4 If something goes wrong

1. Press C (D4), or press A and B together. If you are positioning by hand, let go of the button or press C.
2. If movement is unexpected or does not stop, remove power to the external 12 V adapter. The buttons are a software stop, not an emergency stop (Section 3.3).
3. Isolate power before touching the sieve, bucket or wiring.
4. To restart, release all buttons, then press one fresh. Check the position first. A reset returns the speed to 50 mm/s and treats the current position as zero. That is not a true home position, so re-check the height and clearance before pressing C.

8. Standard Operating Procedure

8.1 Loading a Sample

1. Confirm laboratory access, the authorised handling procedure and the operator, and put on a laboratory coat and safety goggles (see 3.2).
2. Receive the client-prepared sample and follow the authorised laboratory procedure.
3. Note the time the sample leaves ethanol. This starts the exposure clock.
4. Record every transfer between ethanol and any other holding condition.
5. Load the batch into the bucket.

No maximum specimen mass or count was established. Keep specimens free to move and the mesh open; split a batch if crowding or blockage prevents this. Agree any specimen-specific loading and endpoint with Megan or Josh. Stop and inspect for jamming, loosening, splash or unexpected carryover.

8.2 Running a Sort

Each run applies one size cut with one sieve fitted. Run the 3 mm cut first, then put the material retained on the 3 mm sieve through the 10 mm sieve. This gives the three fractions:

- Lower fraction: material collected after passing through the 3 mm sieve. Do not infer an exact specimen size from passage alone.
- Middle fraction: material retained by the 3 mm sieve and then collected after passing through the 10 mm sieve.
- Upper fraction: material retained by the 10 mm sieve. Preserve the fraction label and run identifier during recovery.

The machine cannot tell when a cut is finished, so the operator decides when to stop. For reference, the 6 October specimen run took about 6 minutes at 3 mm and 9 minutes at 10 mm (recalled, not timed).

1. Fit the 3 mm sieve. Stop and isolate power first (see 3.3).
2. Position and start the machine as in Section 7.3.
3. Run the cut, watching the sample, the water depth and the travel.
4. Stop the machine (Section 7.3, step 6) and isolate power.
5. Collect the material that passed through the sieve (lower fraction) from the collection path, and keep the retained material together.
6. Fit the 10 mm sieve, load the retained material and repeat steps 2 to 4. The material that passes is the middle fraction; the material retained is the upper fraction.

Collection path: the inner basin sits within the outer receiving container. Q01 connects the basin outlet to the removable metal filter basket, retained by PART-07. Keep the coarse retained group separate. Recover and label the collected group before changing sieves; clear the collector between fractions to prevent carryover. The bonded Q01 joint stays in place.

7. Record the sieve used, speed setting, run time and any observations needed to repeat the run.

8.3 Recovery & Shutdown

1. Stop the machine and isolate power before reaching in.
2. Recover each size fraction without losing sample identity.
3. Inspect for visible damage and possible misclassification.
4. Return the samples to the required holding condition and add up all time outside ethanol. The total must not exceed 4 hours. Returning to ethanol does not reset it.
5. Shut down by removing power to the external 12 V adapter. Disconnect USB as well when isolating all electronics (Section 3.4).
6. Clean and inspect the system under the authorised procedure, then return it to its starting condition (Section 11.1).
7. Record any blockages, mixed fractions or anomalies, and the corrective action taken.

Use the session record supplied in the reproduction ZIP: session-records/blank_session_record.csv.

Record each removal and return to ethanol; add all outside-ethanol intervals for the batch. Returning a batch does not reset its cumulative total. The accompanying example is illustrative only, not a test result.

9. Verification and Test Evidence

The controlled Verification and Test Plan records 50 cases: 36 Passed, 7 N/A and 7 Closed — accepted limitation. Testing spans mechanical checks on 13 September through client acceptance on 15 October 2026. Procedures, criteria, dated observations and available photographs remain in the individual records. Client disposition closes the seven limited cases without asserting new quantitative results.

Full records: Controlled Test Plan and dated evidence. Current dispositions follow the 15 October client acceptance record and Decision D51.

Test level	Outcome	What was checked and found
Unit - mechanical	UT-MECH-01 to 07: 7 passed	Frame (600 mm high, 235 × 300 mm base) stable with no visible misalignment; lead screw, coupling, rail and carriage run smoothly; printed parts fit; bucket and bowl assemble and come apart for cleaning; carrier holds the bucket. Sieve apertures measured 3.0 mm (flat 3 mm), 10.1 mm (flat 10 mm) and 10.0 mm (curved 10 mm).
Unit - electrical	UT-ELEC-01 to 06: 4 passed, 2 not applicable	Wiring polarity, continuity and insulation; LED states; driver current limit set at VREF 1.28 V (1.60 A); fan ran 10 minutes with correct airflow. No DC–DC converter is fitted and no end-stops are used, so those two tests do not apply.
Unit - control	UT-CTRL-01 to 12: 9 passed, 3 not applicable	Firmware boots and uploads; direction mapping; 30 mm stroke measured 29.7–30.4 mm over at least ten strokes with no missed steps or drift; no unexpected movement at power-up or reset; speed buttons, speed and centre retention, interlocks and USB reset all behave as designed. Ten-cycle times averaged 25.70 s, 12.29 s and 8.54 s at 25, 50 and 75 mm/s. The three end-stop tests do not apply (D46).
Unit - sieve and water	UT-SIEVE-01 to 03: 3 passed	Three static leak holds of just over 10 minutes with no leakage; water drains without problem pooling; wet motion stable with no splashing toward the electronics.
Integration	IT-01 to 12: 9 Passed, 2 N/A, 1 Closed — accepted limitation	Motion, bucket alignment, controls, wet collection, cleaning and refit, enclosure fit and cooling. Wet endurance: 500 cycles over 10 minutes with the bucket in water, fan on and lid closed, with no faults; board temperatures stayed about 25–26 °C at 24 °C ambient. Readiness for specimen work agreed on 12 October. Homing and limit-stop tests do not apply (D46). Counted mock recovery (IT-09) was not done.

Test level	Outcome	What was checked and found
System	ST-01 to 10: 4 Passed, 6 Closed — accepted limitation	Full two-stage workflow with specimens on 6 October (3 mm then 10 mm): startup, sieving, collection, rinsing and shutdown completed without leaks or loosening. The three fractions followed the intended path. Exposure was recalled as about 15–18 minutes. Client acceptance was recorded on 15 October. Evidence limitations for six cases remain in Section 13.

Requirements coverage. The nine test requirements (REQ-T01 to T09) cover size classification, specimen damage, ethanol exposure, laboratory testing, safe motion limits, water/electronics separation, sorting effectiveness, processing time and cleanability. Each is traced to its tests in the Test Plan's requirements traceability sheet.

Client acceptance. On 15 October 2026, Josh Coates accepted the present sorting and the overall system, and Dr Megan Head shared this view (ST-10, Decision D51). Known-size mixed specimens were not available, and many insects had been damaged during preservation, so no new numerical sorting or damage result is claimed.

10. Troubleshooting and Fault Reference

This table holds only issues that were recorded or follow from the safety design. The checks are not validated repair procedures. If a fault isn't listed, stop, isolate power, note the date, settings and what happened, and tell the team.

After an ordinary C-button stop, the established centre and speed are retained. After reset, power loss, suspected slip or a mechanical change, manually re-establish the centre and check clearance. If water reaches electronics, disconnect power and obtain technical inspection before re-energising. If the fan stops or unusual heat appears, stop and inspect; the recorded 10-minute tests are not a continuous-operation temperature rating. For laboratory and specimen questions contact Megan or Josh; for project documentation or source-file queries contact Rui Jiang (Rui.Jiang@anu.edu.au).

What you see	Likely cause	What to check or do	Basis
Motor does not turn	Coil wires paired from different coils, or SLEEP and RESET not linked to 5 V	Power off. Re-identify the coil pairs with a multimeter and check the SLEEP–RESET link.	Recorded during the first build
Carriage moves the wrong way (A moves down)	One coil wired reversed	Power off and swap the two wires of one coil (Section 6.2, Step 4).	Follows from the wiring
Erratic movement or inconsistent response	Nano, driver and motor supply don't share a ground	Power off. Check the supply negative is tied to the driver's motor-side GND and to the Nano's GND.	Recorded in early testing
Skipped steps or a hot driver	Driver current limit set too low or too high	Stop and isolate power before inspecting wiring. Refer to UT-ELEC-05 for the recorded 1.28 V setting on the R100 board. VREF measurement requires powered checks by a competent operator; it is not an unpowered measurement.	VREF recorded (UT-ELEC-05)
No response to a button after a stop	A button is still held down	Release all three buttons, then press one fresh.	Tested (UT-CTRL-10)
Unexpected movement at power-on or during upload	Pin D13 may toggle during boot	Keep the 12 V supply off during firmware upload and keep hands clear at power-on.	Warning in the firmware source; not confirmed by a test
Machine does not stop when asked	The buttons are a software stop only	Remove power to the external 12 V adapter.	Precaution (see 3.3); not tested as an emergency stop
Fan not running	12 V supply off, or fan lead loose	Check the external 12 V supply. Disconnect adapter power before checking fan wiring.	Precaution

What you see	Likely cause	What to check or do	Basis
Water on or near the electronics	Splash or leak	Stop and isolate power. Don't restart until it is dry and inspected.	Precaution. Leak and enclosure checks passed (UT-SIEVE-01, IT-11)

11. Maintenance and Care Guidance

11.1 Between samples and after each session

- Clean and inspect under the authorised laboratory procedure, and remove any retained specimen material.
- Check the sieves for blocked holes, cracks or warping.
- Check the bucket screws are tight and there is no play.
- Dry the machine and check no water is near the electronics.

Keep the glued bowl-to-Q01 joint intact during routine cleaning. Remove changeover sieves and the metal collector as appropriate, clear visible debris, and inspect mesh, seals and joints before drying and storage. Keep water and cleaning agents away from the controller. Megan or Josh directs the applicable laboratory cleaning and specimen-handling method; no chemical-compatibility approval is implied here.

11.2 Regular checks

- Printed parts: look for wear, cracking or deformation. PLA can slowly loosen under sustained load.
- Frame: check the fasteners and T-nuts are tight and the carriage moves freely without binding.
- Electrical: check insulation, connectors and cable restraint, keep the fan vents clear and confirm the fan runs.
- Threaded rod and bearings: check the motion is smooth.

11.3 After replacing a part

- Record the material, print orientation and part ID.
- Use the selected reproduction settings where recorded; where historical settings are missing, follow the scope and fit-check requirements in Section 12.4.
- Repeat the checks the part affects, such as fit and retention.

11.4 Firmware

- Use the 12 October Controller_Source.zip and its README. Keep entosieve_clickspeed.ino and the bundled FlexyStepper.cpp/.h together as a separate sketch. No FlexyStepper release number is recorded. The earlier 1 October source is archived. 12 October firmware package

  Sketch · FlexyStepper.cpp · FlexyStepper.h · README
- Disconnect 12 V motor power; connect USB. The package was compiled for arduino:avr:nano:cpu=atmega328. This is a build-validation target, not confirmation of the installed bootloader or upload setting. After upload, open Serial Monitor at 115200 baud. Release all buttons; confirm ENTOSIEVE_CLICKSPEED_20261012, RUN_MIN_MM_S=10.00 and READY.
- Keep 12 V disconnected. Press D4, then press D3 eight separate times, releasing between presses: the setting should reach 10 mm/s. Another D3 press stays at 10; D2 raises it to 15. Press D4 to stop. Reset with motor power disconnected before physical checks

because this dry check changes software position. Record changes and repeat the button/stop checks.

12. Reproduction Guide

This section explains how to build a second unit. It points to the other sections and does not repeat them.

12.1 What you need

- The parts in Section 4, and the print files listed in the current Configuration Manifest, which identifies the current version of each file.
- A 3D printer and PLA. The recorded recipe for the U02 enclosure lid is Prusa MK4S, 0.4 mm nozzle, 0.20 mm layers, four walls and 15% gyroid infill.
- Basic hand tools, a soldering iron and a multimeter.
- The Arduino IDE and the firmware package ENTOSIEVE_CLICKSPEED_20261012 with the FlexyStepper library. Record the board and library versions you use.

12.2 Order of work

1. Order the parts (4.2 to 4.4) and print the parts (4.1) using the Manifest files.
2. Build the frame and motion system (Section 5, Steps 1–18).
3. Fit the carriers, sieve-holder frame and bucket (Steps 19–22).
4. Build the wet end using Section 5.1. It brings together the basin fabrication steps, six process photographs, current Q01 and filter-ring sources, and dated water results. Open basin assembly
5. Wire the electronics (Section 6) and set the driver current limit.
6. Upload the firmware with the motor supply off.
7. Check the buttons and stopping (Section 7) and compare against Section 9.
8. Record what you actually built and any differences from this guide.
9. Don't run samples until laboratory access and the operator are confirmed (3.2).

12.3 Files

Open the shared handover folder for the current guide, configuration manifest and downloadable reproduction package. Extract the complete package before using its workbook's relative source links. Test Plan links open the dated evidence. Open current handover files

Delivery record: 15 October machine and accessories; final handover 20 October

12.4 Reproduction choices for a future build

- Use Section 5.1 for basin fabrication and photographs. The reproduction table identifies the selected wet-end and controller parts.
- The selected U02 upper assembly has a shared 3MF project and STL geometry. Use it with the retained B01 body and four PCB clamps. U02 print project and STL
- Saved carrier v3 settings are available in the reproduction package. B01/B02 recipes remain review candidates; they do not establish historical print settings. Select the printer, nozzle and consumables, then verify fit for a future build.

- Confirmed joint sizes and quantities appear in Section 5, Section 7.1 and the reproduction table. The controller stands separately from the frame; controller-to-frame fasteners and the original Spacer Controlbox are not applicable. Preserve this separation from the wet area when reproducing the arrangement.
- Obtain current supplier quotes and select compatible tools, replacement electrical consumables and adhesive-specific preparation before a new build. These future choices are not conditions of the accepted machine's closeout.

Optional future sieve sizes

Six optional basket-and-lid pairs provide nominal 4, 5, 6, 7, 8 and 9 mm apertures. They preserve the published design family and are supplied as future reproduction choices. These 12 STL files are not part of the accepted machine or the additional items delivered on 20 October 2026. Geometry checks are digital only; the files have not been sliced, printed, fitted or tested. No print-mass, duration or sorting result is claimed.

Optional 4–9 mm baskets and lids — source files | Drive download

For a future first-time operator, a short supervised walkthrough can cover isolation, manual positioning, a clean-water run and fraction collection. No separate first-user walkthrough was recorded; this is future-use guidance, not an outstanding project acceptance condition.

13. Known Limitations and Support

13.1 Operating limitations

- No automatic homing, end-of-travel switches or over-travel protection (Decision D46). Holding A or B keeps the carriage moving with no travel limit, so the operator must set the position and check 15 mm of clearance each way before starting.
- The buttons provide a software stop, not an emergency stop. Remove power to the external 12 V adapter to isolate the motor supply.
- The machine cannot tell when a cut is finished; the operator decides the run time.
- Speeds are commanded settings, not measured speeds. A reset sets a software zero, not a physical home position.
- Board temperatures were observed only in 10-minute runs at 24 °C ambient. The thermal capacity of the driver and enclosure is not established for longer runs or warmer rooms.
- The two potentiometers on the board are not used by the firmware.

13.2 Limits of the test evidence

- Sorting accuracy was not measured (ST-02). The three fractions followed the intended path, but correct and intruder specimens were not counted.
- Behaviour at the 3 mm and 10 mm boundaries was not tested specimen by specimen (ST-03).
- Damage caused by the machine was not separated from damage during preservation (ST-04).
- Exposure and processing times were recalled rather than timestamped (ST-05 and ST-06).
- Run-to-run repeatability was not measured (ST-07).
- A counted mock-recovery test was not performed (IT-09).

IT-09 and ST-02 to ST-07 are Closed — accepted limitation under Decision D51 and the 15 October client acceptance record. Their quantitative criteria remain unverified. Closure records the accepted project scope; future quantitative evaluation would require new measurements.

13.3 Optional post-acceptance support

- The additional bucket-to-arm connector, existing spare portafilter and PART-07 threaded ring were checked and ready on 18 October, then handed over on 20 October 2026. Completion was confirmed on 21 October. The connector and ring were printed; the portafilter was an existing spare.
- The shared source route and U02 upload are complete. Section 12.3 links the files; a QR code is optional. Client account access is not claimed by this publication.
- The recorded fastener interfaces are reconciled. Section 12.4 identifies choices for a future build; they are not unfinished assembly tasks. No new mechanical test result is inferred from this document update.

14. Change Log and Version History

Version	Date	Summary of change
v0.1	26 Aug 2026	Initial working draft. Sourced content from ConOps v1.5 and PMP v0.5 where confirmed; all other sections flagged.
v0.2	09 Sep 2026	Merged in the first mechanical assembly report (Section 5, with photos) and the wiring report (Section 6).
v0.3	27 Sep 2026	Restructured Section 6 into plain steps (purpose, components, build order, issues). Added caution notes on bucket-carrier fit, stop-switch behaviour, the speed/distance dials and the wet-end redesign not yet built. Removed internal document-process references.
v0.4	05 Oct 2026	Revised after Rui Jiang's 1 October review. Sections 3 and 6 rewritten for the three-button control scheme (firmware ENTOSIEVE_CLICKSPEED_20261001), with the limit-switch and potentiometer design kept as history only. 1 October test results added to Section 9. Section 4 parts relabelled as a historical reference list. Size bands in Section 2 corrected to the ConOps wording. "Current working draft" banner and contents list added.
v0.5	11 Oct 2026	Wording completed for Sections 3.2–3.3 (access, stopping). Supplier tables added in Section 4 (4.2–4.4). Wiring steps and tables in Section 6 updated for the button controls. Sections 7 and 8 separated into machine procedure and sample procedure. Sections 9–12 written from the current Test Plan results.
v0.6	16 Oct 2026	Section 3: 4-hour exposure limit, PPE and new 3.4 Electrical Safety with the power-on and shutdown sequence. Section 4: Australian suppliers and AUD prices, current bucket and sieve parts added, bearing quantity corrected to 2. Section 5: missing coupling step restored (now 22 steps), step references and outdated notes fixed. Section 6 rewritten for the installed build (firmware ENTOSIEVE_CLICKSPEED_20261012, driver settings, VREF, coil colours, fan, 220 Ω resistors). Sections 7–8: setup instructions, sieve order, water depth check and power sequence added. Section 9 written as a verification summary. Sections 10–12 updated. Section 13 written.
v0.7	16 October 2026	Navigation and evidence alignment of the current folder copy; existing review limitations retained. Added basin fabrication, dated tests and client acceptance links. Aligned seven dispositions with Test Plan v1.25; quantitative evidence limits and original criteria remain unchanged.
v0.8	17 October 2026	Aligned controls, current assembly and recipe boundaries; corrected LED/motor replacement guidance; linked manufacturer decoupling and firmware recovery sources. Refreshed cover and contents. Existing comments, review limitations and historical test outcomes retained.

Version	Date	Summary of change
v0.9	18 October 2026	Reconciled confirmed fasteners, quantities and washer rules; linked shared U02 sources. Recorded the separate controller and unused Spacer Controlbox. Corrected adapter-isolation instructions. Separated historical and future-build choices from current closeout; preserved review comments.
v0.10	18 October 2026	Integrated basin fabrication steps and six process photographs into Section 5.1, with current Q01 source selection and later water results. Retained the existing wiring chapter and clarified its navigation. Preserved original report links and review comments.
v0.11	18 October 2026	Corrected the Section 7.2 pre-use checklist to name the installed external 12 V adapter. Hardware, operating sequence and test evidence are unchanged.
v0.12	18 October 2026	Formal release. Added direct GitHub model, print-project and firmware links beside the corresponding parts and code. Retained Drive evidence, saved-recipe limits and existing review comments. Additional handover items confirmed ready and checked; delivery planned for 20 October.
v0.13	18 October 2026	Added missing BOM photographs and STL previews; linked saved slicing mass/time estimates and clarified their scope. Resolved the 19 end-user review annotations through existing evidence, operating guidance and explicit limits. Added optional 4–9 mm future designs and session-record templates.
v0.14	21 October 2026	Recorded the completed 20 October handover of the additional connector, existing spare portafilter and threaded ring, confirmed on 21 October. Updated current delivery wording; optional 4–9 mm designs remain outside the delivered scope.