

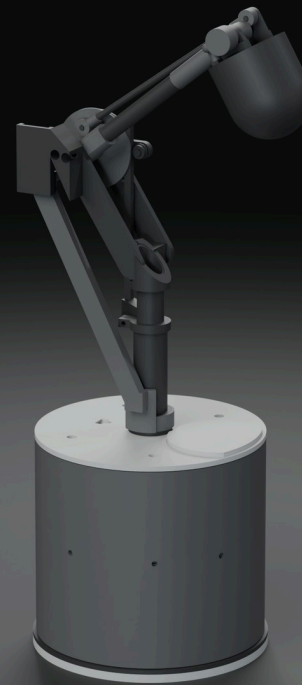
AXON

One ring sets height, tilt and direction.

SPECIFIED INTENT C-001 · DESIGNED C-031

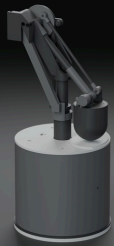
Designed and analysed – prototype in progress

h 340 mm, φ -60°, β 0° at TASK, θ 170°
DESIGNED C-031, C-074

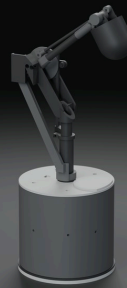


Render from CAD – DESIGNED

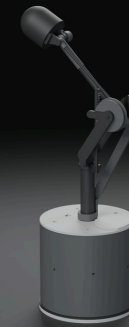
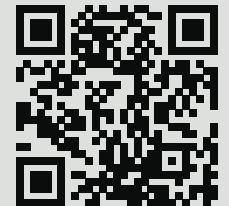
the TASK render of phase2-cad-freeze-r2 (2c7bc9a), clay toned by function (fixed light, moving dark, bought darkest; not CMF), at LEAD_DEG 9.80° (TP-01 sets the lead); h, φ , β from docs/phase2/results/p2_visual.json · DESIGNED C-091 · SPECIFIED INTENT C-092



$h \ 160 \text{ mm} \cdot \varphi \ -90^\circ \cdot \beta \ 0^\circ$



h 340 mm · φ -60° · β 0°


$$h \ 400 \text{ mm} \cdot \varphi \ +30^\circ \cdot \beta \ 180^\circ$$


The thesis in one chart

Ring angle alone sets h , φ and β : the pan holds at 0° from STOWED through TASK (θ 0 – 172°) while the head rises 180 mm and tilts 30° , then turns 180° by θ 268° as the head rises 60 mm more.

DESIGNED C-031, C-094, C-045 · SPECIFIED INTENT C-008

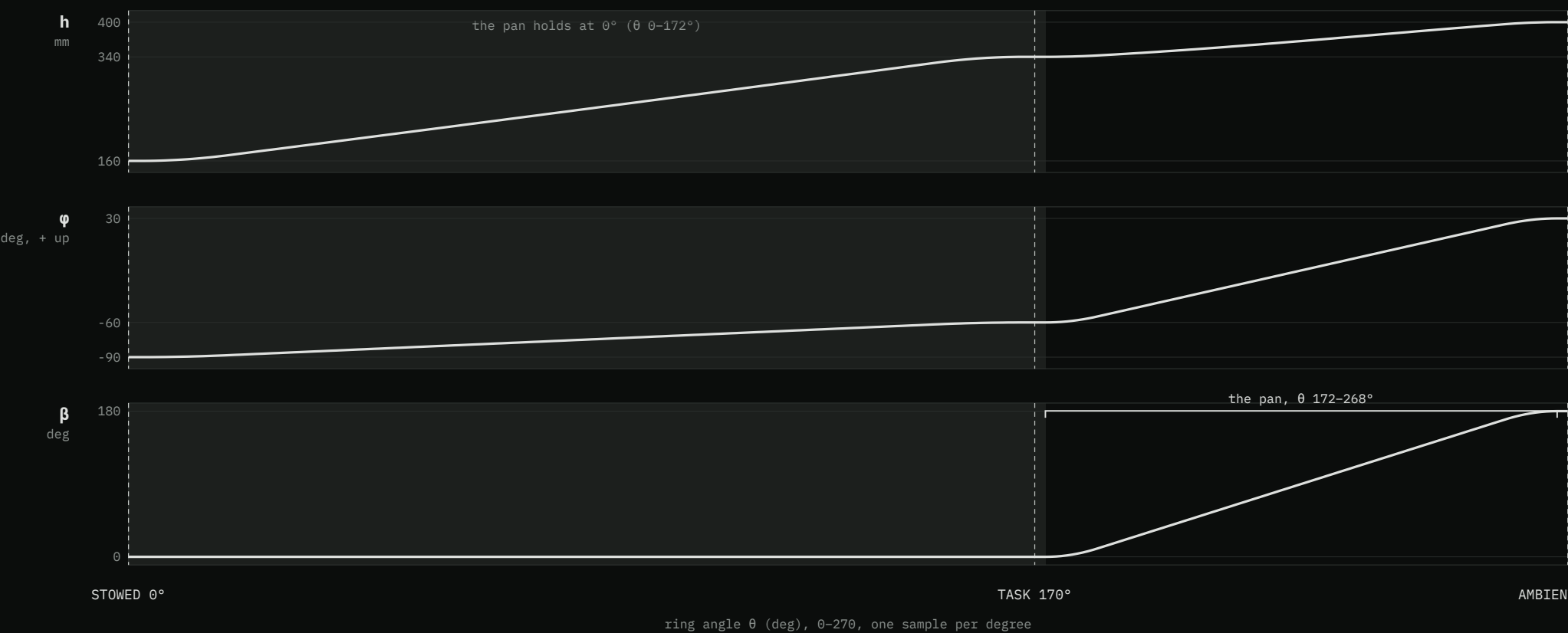


Chart from the results – DESIGNED

docs/phase2/results/p2_visual.json (the kinematic model at the CAD's lead; h in the model's frame: on its 5 mm foot the lamp stands 3.5 mm higher, C-078)

Why a cam

The owner's scored criteria tied (all three hold by geometry); effort and the stowed form chose the cam: 254 N·mm re-sized against 385 and 399, and it is the only nested form with no collision inside the mass target.

DESIGNED C-021, C-022, C-023, C-027 · SPECIFIED INTENT C-024

	cam	gear	linkage
peak ring torque as drawn, μ 0.20 DESIGNED C-021, C-022, C-023	419 N·mm	585 N·mm	647 N·mm
re-sized for a measured μ 0.20 DESIGNED C-027	254 N·mm	385 N·mm	399 N·mm
re-sized and nested at STOWED: collisions DESIGNED C-027	0	2	0
... lamp mass needed (target $\leq$ 2000 g) DESIGNED C-027 · SPECIFIED INTENT C-024	996 g	1546 g	2576 g
beam tips past vertical in transit DESIGNED C-021, C-022, C-023	0.0 deg	1.6 deg	11.9 deg
parts (the honest cost) DESIGNED C-021, C-022, C-023	97	61	128
printed sliding contacts under load (the cost) DESIGNED C-021, C-022, C-023	7	4	2

97 parts in the Phase 1 model → 79 pieces as drawnDESIGNED C-021, C-094

Phase 1 idealised stick models (2026-10-07, D-011); the r2 design differs in detail. The owner chose the cam in D-012.

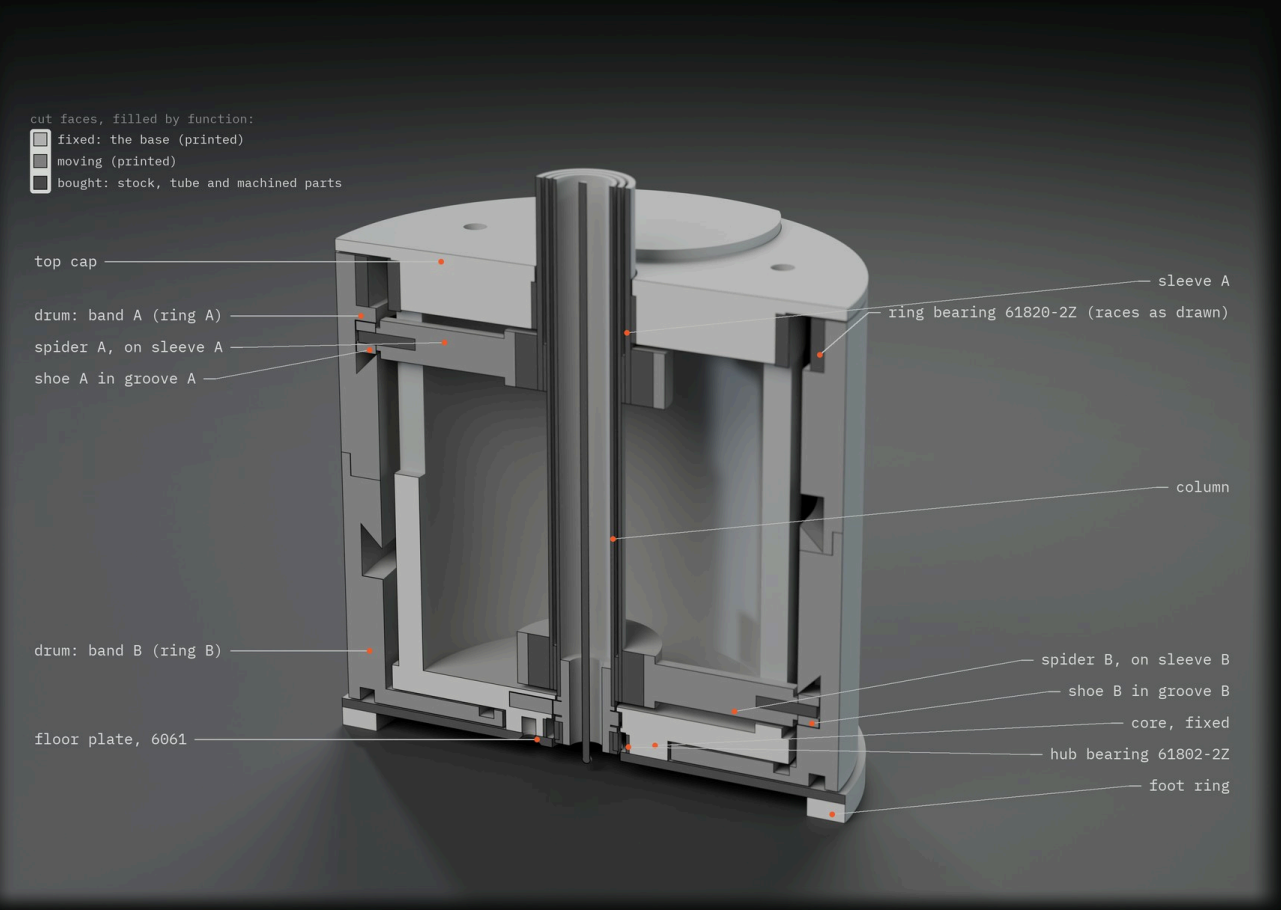
Table from the results – DESIGNED

docs/phase1/results/cam.json, gear.json, linkage.json, d011.json (the same selectors as kinematics/recommend.py); the note: docs/phase2/results/assembly.json

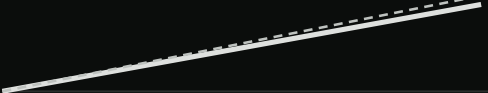
How it holds: by geometry

No brake and no balance spring: each shoe rests on a groove flank cut 10.29° steep, under the friction angle 11.31° at the provisional μ 0.20, so the head's weight cannot turn the ring: holding by geometry, by 1.02° ; TP-01 sets the lead for a 2° margin once μ is measured ($\mu_{lo} \geq 0.184$).

DESIGNED C-036, C-094, C-041 · SPECIFIED INTENT C-040



the locking flank, 10.29°
the friction angle at μ 0.20, 11.31°



margin 1.025° (rule: $\geq 2^\circ$)
the angles are drawn true; the gap between the lines is the holding margin

The detents only click (89 N·mm to lift the ball) and the pins at 0° and 270° only stop: neither holds a pose.

DESIGNED C-074

Exploded, layer by layer

One stack on one axis: 67 drawn parts (79 pieces), layer by layer out from the fixed core; 12 of them change shape with the lead TP-01 sets.

DESIGNED C-094, C-083

the layers, in stacking order

0 core (4 parts)

1 hub stack (3 parts)

2 ring B (2 parts)

3 floor plate (3 parts)

4 foot ring (1 part)

5 ring A (1 part)

6 column, sleeves, spiders and shoes (14 parts)

7 ring bearing (2 parts)

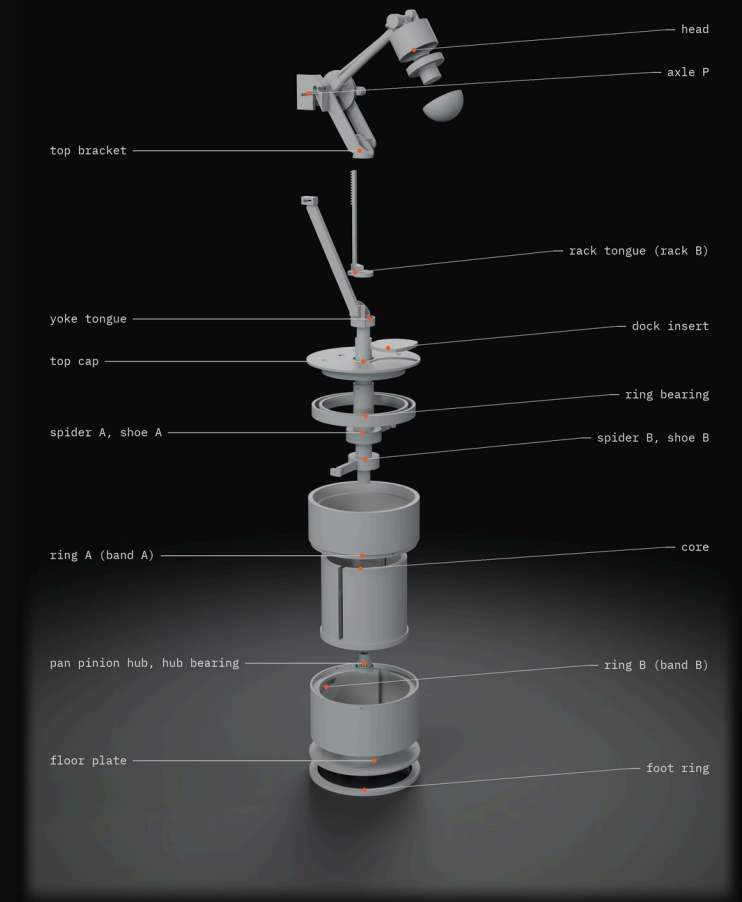
8 top cap (2 parts)

9 dock insert (1 part)

10 tongues (2 parts)

11 bracket, arm and head (31 parts)

The floor plate, the stop pin, the cord carrier and the foot are fitted last, after the ring is set at TASK (DETENTS.md > Assembly); the explode shows where each sits, not the build sequence.



Render from CAD — DESIGNED

the exploded render of phase2-cad-freeze-r2 (2c7bc9a); the layers from cad/render_export.py; the counts from assembly.json (e95c3bf) · DESIGNED C-086

Found and fixed: the split drum

Gravity pushes shoe A up and shoe B down everywhere in the travel, so a one-piece drum would print one locking flank face-down, a 80.2° overhang against the 45° the design prints; the drum is two bands, each printed with its locking flank face-up.

DESIGNED C-094, C-048

PROBLEM

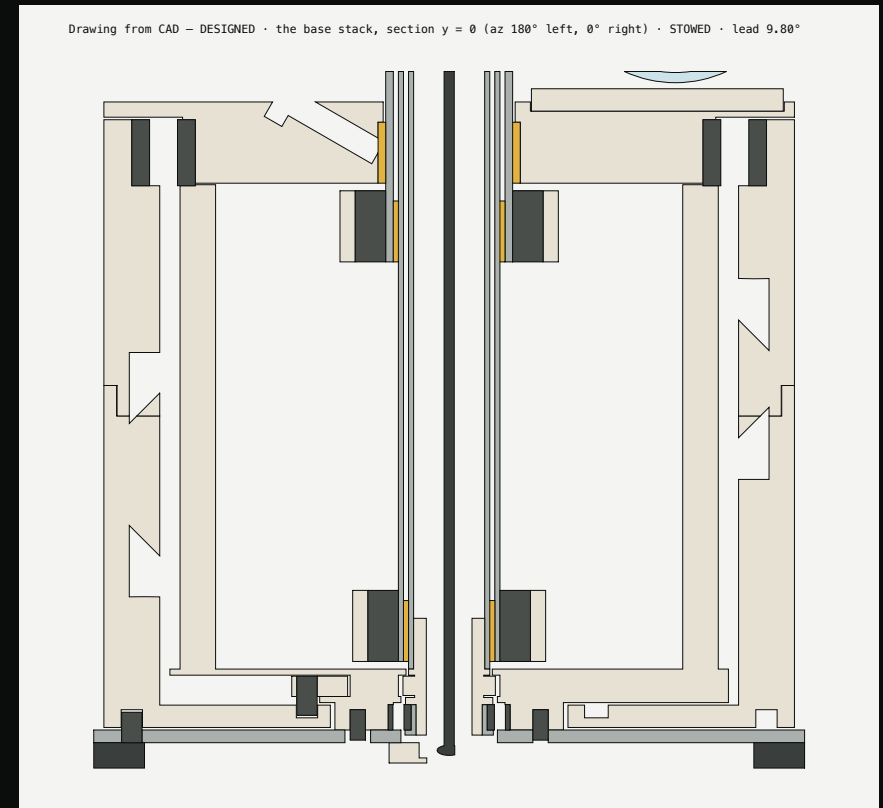
80.2° overhang

The two shoes' loads point opposite ways at every lead and angle, so one of the two locking flanks faces down.

FIX

$\leq 45^\circ$ overhang

Two bands, ring A printed upside down and ring B upright, each locking flank face-up, joined at a lapped seam; both shoes sit on their locking flanks at every sampled angle and lead.



the base stack in section at STOWED

Found and fixed: the floor plate

A 2.5 mm printed floor plate sank up to 0.48 mm at the rim against the 0.5 mm running gap under ring B; the same plate in 6061-T6 sinks 16 μm and keeps at least 0.48 mm, with the detent's breakout 1.65–1.91 $\times$ the floor at μ 0.20.

DESIGNED C-076, C-074, C-094

PROBLEM

0.48 mm sag

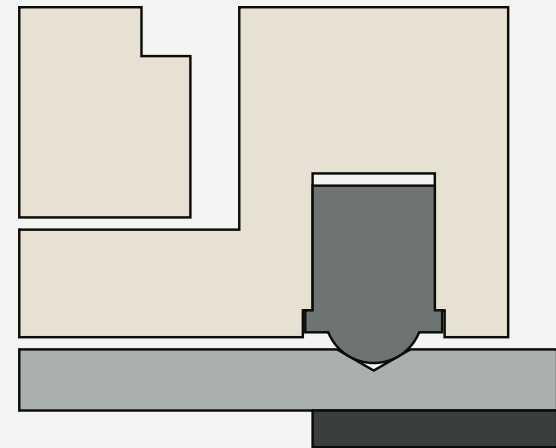
PLA at 2.0 kg: the core sinks 0.30–0.48 mm at the rim and closes ring B's gap.

FIX

16 μm

The same 2.5 mm plate in 6061-T6, 23–34 $\times$ as stiff in bending: the rim gap stays $\geq$ 0.48 mm; +73 g.

Drawing from CAD – DESIGNED · the detent through the plunger's axis, ball seated, radius to the right · TASK · lead 9.88°



the detent in section at TASK: ring B, the plate, the foot

Found and fixed: rack B's backing roller

A 5 N push on the stowed head would have bent rack B 4.3 mm off a 2 mm-deep mesh; a roller behind the rack keeps at least 1.92 mm engaged at every pose and lead, for at most 0.33 N·mm of ring torque.

DESIGNED C-080, C-082 · SPECIFIED INTENT C-081

PROBLEM

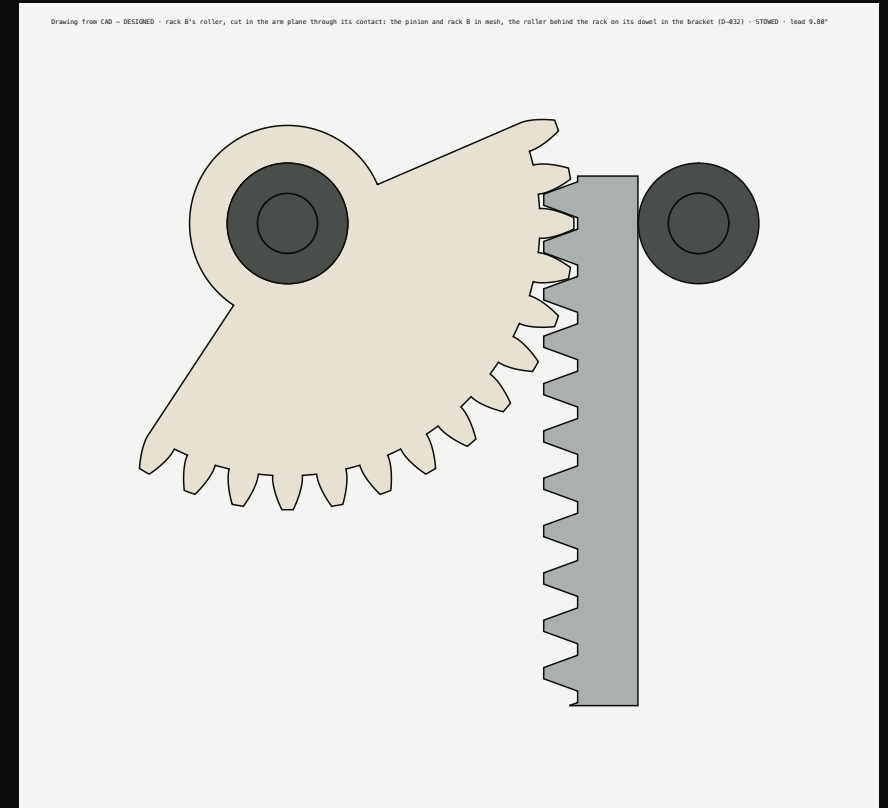
4.3 mm off the mesh

Under the 5 N push the head front deflected 13.7 mm; rack B's blade bent away from the tilt pinion, past the teeth's working depth.

FIX

1.92 of 2 mm

A flanged ball bearing on a dowel behind rack B, opposite the mesh: R-12 1.65 mm (base held) against 2.



rack B's roller cut in the arm plane at STOWED

The honest stack

Two targets are not met by design, and both are shown: free play through the ring 2.71 mm against 0.5 (R-12a) and under a reversing push 17.07 mm against 17 (R-12b, provisional); both are measured in Phase 3.

DESIGNED C-070 · SPECIFIED INTENT C-079, C-056, C-066

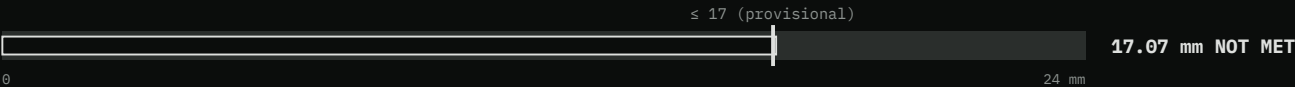
R-12a free play, ring only

chain 0.52 + base stack 2.19 (every fit counted) · DESIGNED C-070 · SPECIFIED INTENT C-079



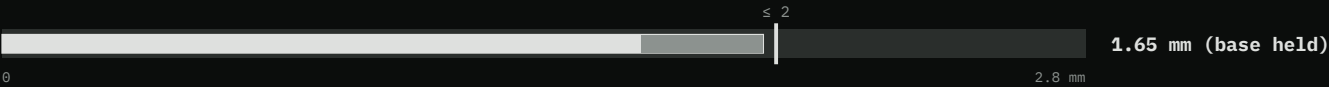
R-12b play under a reversing 5 N push

set again by TP-02's measured fits · DESIGNED C-070 · SPECIFIED INTENT C-066



R-12 deflection under 5 N

1.68-1.97 on the foot · since the roller · DESIGNED C-082



31 targets at the freeze: 1 accepted by the owner, 14 met by design, 9 decided by a test, at assembly or on receipt, 5 not set, 2 not met by design (R-12a, R-12b not met); 0 measured.

The detent's breakout (1.65-1.91× the floor) is met only at the provisional μ 0.20 (C-076); holding by geometry waits for TP-01's measured μ (frame 5).

How it gets validated

The pass criteria were committed before any reading: the coupons' on 2026-10-07 (TP-01, TP-02), the pair-selection rule (D-017) and the frozen analysers (D-019). Nothing is VALIDATED yet.

SPECIFIED INTENT C-039, C-040

TP-02 · fits ladders

clearance and press ladders, each bracketing its fit; a ladder that does not bracket is reprinted, never extrapolated (TP-02 Rev B, criteria Rev A f3df71e)

DESIGNED C-038 · SPECIFIED INTENT C-060

TP-01 · flank friction

2942 g on the shoes (9.62 N per shoe, groove A's largest); P1 run-in μ spread ≤ 0.06 with CV $\leq 15\%$; P2 $|\mu_{\text{runin}} - \mu_{\text{fresh}}| \leq 0.05$; P3 no cracking or transfer; P4 lever end ≤ 1 mm (TP-01 Rev C, criteria Rev A f3df71e)

DESIGNED C-031 · SPECIFIED INTENT C-039

the selection rule (D-017)

margin $\geq 2^\circ$ at the lowest corrected μ ; lamp ≤ 2000 g on desk $\mu \geq 0.6$; nested ≤ 15 mm

SPECIFIED INTENT C-040 · DESIGNED C-041

Phase 3 on the prototype

free play R-12a ≤ 0.5 mm and R-12b ≤ 17 ; deflection ≤ 2 mm under 5 N; the base walk at desk $\mu \geq 0.6$; the detent's breakout 1.5-2x

SPECIFIED INTENT C-053, C-056, C-066, C-028, C-030

not set yet

R-07 (ring torque), R-09 (backlash at the head) and R-11 (cycles): their targets wait, so they are not claimed

Status and next

Designed and analysed, nothing measured: 97 claims, 40 DESIGNED and 57 SPECIFIED INTENT, 0 VALIDATED. The next step is the coupons.

process note: counts of docs/claims_ledger.csv

- now** the CAD frozen as phase2-cad-freeze-r2; the order list ready (53 lines), nothing bought
SPECIFIED INTENT C-092, C-095

- 1** TP-02: the fits ladders print (print run P02), measured on the bench sheet
DESIGNED C-038

- 2** TP-01: the flank-friction coupons (C1 first), the analyser frozen before the data
SPECIFIED INTENT C-039

- 3** the rule sets the lead; the 12 lead-dependent parts are cut and printed
SPECIFIED INTENT C-040 · DESIGNED C-083

- 4** the prototype assembled; Phase 3 measures every target above
SPECIFIED INTENT C-079

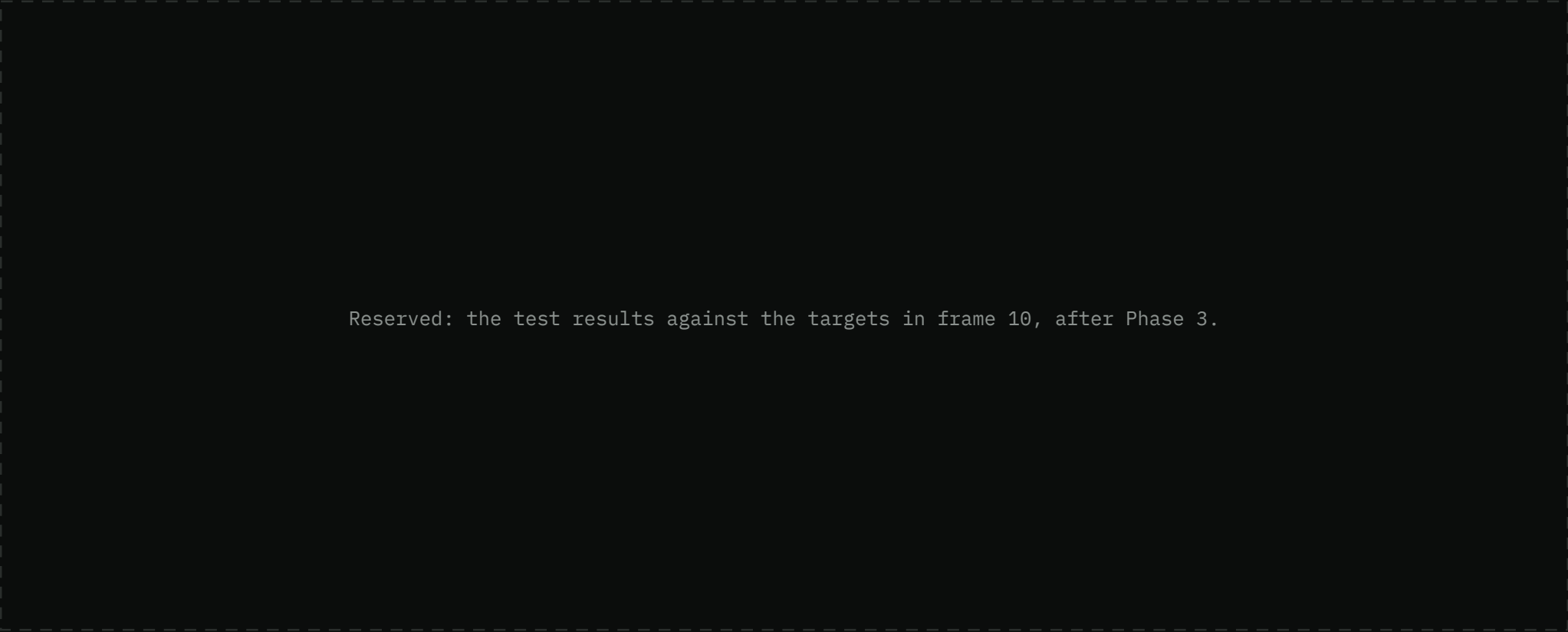
The prototype

Nothing here is claimed yet.

Reserved: photographs of the printed prototype at each detent, after Phase 3.

Measured

Nothing here is claimed yet.



Reserved: the test results against the targets in frame 10, after Phase 3.