

NanoArc PCM Test-Cell Qualification Workbook

Incoming Inspection, Water Blanks, and Thermal Baseline

Status	Approved protocol; no qualification run completed
Revision	Rev0
Date	2026-08-13
Design	NanoArc 5 g PCM Test-Cell Family Rev0
Authority	Tristan approves fixture release and cell qualification

This workbook qualifies practical laboratory use of the cell fixture. It does not establish a pressure rating, production cartridge, or Rumi safety/duty-cycle claim.

Stop rule. Stop immediately on glass damage, leakage, stopper movement, sensor disagreement, uncontrolled heating, bath boil-dry, guard failure, or any unexpected pressure indication.

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Campaign identification

Field	Record
Campaign ID	
Operator	
Date range	
Vial supplier / part / lot	
Stopper supplier / part / lot	
PTFE tape supplier / lot	
Kapton tape supplier / lot	
Fixture revision / photo directory	
Webcam file directory	
Tristan authorization	

Incoming inspection

Inspect every pilot vial under strong light. Reject chips, scratches, cracks, bubbles affecting the wall, neck damage, contamination, or closure defects. Never engrave the glass.

Cell envelope ID	OD mm	Height mm	Empty mass g	Neck/closure fit	Visual result	Disposition
				Pass / Fail	Pass / Fail	
				Pass / Fail	Pass / Fail	
				Pass / Fail	Pass / Fail	
				Pass / Fail	Pass / Fail	
				Pass / Fail	Pass / Fail	
				Pass / Fail	Pass / Fail	
				Pass / Fail	Pass / Fail	
				Pass / Fail	Pass / Fail	

Attach the remaining vial inventory as a continuation sheet using the same fields.

Fixture and identification preflight

Check	Acceptance	Result / evidence
Metal cradle location	No glass contact with bath vessel or heater	
Fixed-stop retainer	Stop dimension recorded; no arbitrary compression	
Stopper seating	Repeatable installed height	
Guard and tray	Full fragment/splash interception	

Check	Acceptance	Result / evidence
Above-bath printed parts	PETG only; no hot structural role	
Hand-tool fallback	Metal fallback documented	
Cell-wall sensor datum	Marked, dry, repeatable, photographed	
Cold-spot reserve area	Visible and unobstructed	
Identifier	Paint/marker plus engraved metal duplicate	
Webcam	Both displays and clock continuously readable	
Safe removal	Cell can be handled without forcing stopper	

Preflight disposition: **Pass / Fail / Conditional**

Reviewer and date: _____

Instrument calibration

Calibrate the DMM thermocouple and bath thermometer together before the campaign. Record the actual bath condition; do not force either reading to the nominal value.

Point	Reference condition	DMM cell probe	Bath thermometer	Difference	Pass/notes
Ice	Stirred ice-water slurry	C	C	C	
Hot	Stirred hot water, reference temperature recorded	C	C	C	

Cell-probe tape type/lot: _____

Marked bead height: _____ mm from vial bottom

Wrap count and width: _____

Placement photograph: _____

Water-blank preparation

Prepare three independent cells, each containing 5.000 +/- 0.005 g distilled water. Use the same closure process intended for SAT cells.

Cell ID	Empty vial g	Water g	Closed mass g	Stop height mm	PTFE turns	Photo
WB-1						
WB-2						
WB-3						

Per-cycle run log

Use one copy of this table per cell and temperature stage. Record the matching webcam filename and retain the full video.

Cell: _____ Stage: **65 C / 80 C** Video: _____

Cycle	Start	Peak bath C	Peak wall C	Stopper shift	Leakage/contamination	Fault/event	Pass
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

Ten-cycle inspection

Field	Before	After	Change / result
Closed cell mass	g	g	g
Stopper installed height	mm	mm	mm
PTFE seam condition			
Glass condition			
Identifier legibility			
Sensor tape condition			

Pilot pass requires all three cells to complete ten 25-65 C cycles before any 80 C stage. The 80 C stage is a separate ten-cycle qualification. Reject on:

- visible leakage, stopper displacement, glass damage, or uncontrolled heating;
- sensor disagreement unexplained by measured lag;
- individual ten-cycle mass change greater than 0.02 g;
- loss of guard, fixture, tape, identifier, or video integrity.

The 0.02 g criterion is a pilot leak screen, not the formal SAT mass-retention gate.

Thermal baseline

After water blanks pass, run sequential baselines with identical fixture and sensor placement:

1. empty closed cell;
2. 5.000 g distilled-water cell;
3. 5.000 g pure-SAT cell after stock qualification;
4. SAT-SEED+ control using the same SAT batch.

Run ID	Contents	Profile	Bath-wall lag	Wall offset	Event visibility	Video	Pass
	Empty		s		C		
	Water		s		C		
	Pure SAT		s		C		
	SAT-SEED+		s		C		

Do not claim a 0.5 C/min profile until measured bath data demonstrate the rate. Document the actual ramp, holds, overshoot, cooling method, wall lag, and ambient conditions. A crystallization event is credited only when the wall transient is distinguishable from the simultaneously recorded bath behaviour.

Formal readiness gates

Gate	Requirement	Status / evidence
Incoming inspection	All used vials and closures accepted	
Fixture	Fit, fixed stop, guard, tray, removal pass	
Instrumentation	Two simultaneous channels calibrated	
Logging	Displays and clock continuously readable	
65 C blanks	3/3 cells, 10/10 cycles each	
80 C blanks	3/3 cells, 10/10 cycles each	
Baselines	Empty, water, pure SAT, SAT-SEED+ characterized	
Formal weighing	0.001 g scale available and verified	
Ramp claim	Actual rate demonstrated or claim withheld	

The formal mass-retention requirement is no more than 0.2% per ten-cycle block, equal to 0.010 g for a 5.000 g specimen. The present 0.01 g scale cannot support a defensible pass at that boundary. Require 0.001 g resolution before marking this gate passed.

Failure, archive, and approval record

Cell ID	Failure or completion	Immediate action	Photo/video	Final disposition
				Archive / open / discard
				Archive / open / discard
				Archive / open / discard

Archive representative successful cells intact when storage permits. Record any destructive opening, recovery, breakage, disposal, or inability to archive.

Fixture qualification decision: **Approved / Rejected / More evidence required**

Authorized variants: **STD / COLD interface only / RSEED interface only**

Unresolved limitations: _____

Tristan signature/date: _____

References

- Chemistry/PCM_Cells/NanoArc_PCM_Test_Cell_Family_Rev0.md
- Chemistry/SAT/NanoArc_SAT_Crystallization_Route_Plan_Rev0.md
- J. Li, M. A. Parkes, and C. G. Salzmann, *Crystal Growth & Design* 24 (2024), DOI 10.1021/acs.cgd.4c00691.