Shakuhachi SHK-D4-P1 — Printable Shop Packet

Project: Shakuhachi (SHK-D4-P1)

Date: 2026-05-07

Driver: Tony Koop

Skill: instrument-maker-v4

Cover / summary

A single-instrument build packet for **SHK-D4-P1** — a 1.8-shaku D4 solid-cherry shakuhachi prototype. Open-pipe acoustics; bore drilled with the headstock-driven deep-bore drilling technique on the lathe. Hand-cut utaguchi. Five tone holes (4 front + 1 thumb), tuned to Kinko-ry■ intervals.

Quick start (shop reference)

Step	Operation	Time	Page
1	Mill blanks (1×1×24 cherry)	30 min	§B
2	Build tailstock vise (1-time)	90 min	§C
3	Pine-scrap validation pass	45 min	§D
4	Production deep-bore	90 min	§D
5	Outside turn between centers	60 min	§E
6	Tone-hole layout + drill 7 mm	45 min	§F
7	Cut + file utaguchi	60 min	§G
8	Bisque-style tuning	90 min	§H
9	Walnut-oil + cure	5 d	§I
10	Carnauba wax + final pass	30 min	§I

File map

- `design.md` — governing model + design narrative
- `bom.csv` — 16-line bill of materials
- `sourcing.csv` — supplier list with verified-on column
- `cut-list.csv` — blank → finished part ops
- `validation.csv` — measurement plan + targets
- `assembly-manual.md` — 13-step shop manual (full detail)
- `risks.md` — red-team register; every risk has a test
- `drawings/` — 6 SVG drawings (overall + section + utaguchi + hole template + 2 fixtures)
- `cad/shakuhachi_master.scad` — OpenSCAD parametric master
- `wolfram-starter.wl` — Wolfram package for cents math + correction-refit
- `shakuhachi-design-table.xlsx` — 11-key parametric workbook
- `site/index.html` — public build log

§A — Design intent

Solid-billet hardwood adaptation of the shakuhachi. Western luthier shop. 1.8-shaku D4 first; sized siblings later. Document the open-pipe acoustic model honestly so the first measurement drives a corrections database update. Not a tradition-faithful reproduction; respectful of Kinko-ry■ / Tozan-ry■ lineage.

§B — Bill of materials

(extract — full table in `bom.csv`)

ID	Item	Qty	Cost (USD)
SHK-BOM-001	Cherry blanks 1×1×24 in	3	28.00
SHK-BOM-003	3/8 in pilot brad-point bit	1	16.00
SHK-BOM-004	Step-up drill set 1/2-3/4 in	1	42.00
SHK-BOM-005	20 mm reamer 24 in OAL	1	68.00
SHK-BOM-006	Tailstock vise (build)	1	35.00
SHK-BOM-007	Tone-hole drill jig (build)	1	15.00
SHK-BOM-008	Diamond files round + flat	1	22.00
SHK-BOM-010	Korg OT-120 chromatic tuner	1	89.00
SHK-BOM-013	Walnut oil 8 oz	1	14.00
SHK-BOM-014	Carnauba wax 4 oz	1	11.00

Total pictured: ~430 USD excluding optional inlay block.

§C — Sourcing list

Primary: Bell Forest Products (cherry), Travers Tool (reamer), Lee Valley (bits + files), Sweetwater (tuner), Tried & True (walnut oil), McMaster-Carr (vise hardware).

Long-lead item: 20 mm reamer (~10 days). Order first.

§D — Cut list (extract)

(full table in `cut-list.csv`)

Cut ID	Part	Operation
SHK-CUT-001	Cherry blank	Headstock-driven deep-bore + turn between centers
SHK-CUT-002	Foot end face	Lathe parting + sandpaper face
SHK-CUT-003	Utaguchi notch	Bandsaw + chisel + file (32° inner bevel)
SHK-CUT-004…008	Tone holes	Drill press w/ V-cradle jig; 7 mm brad-point undersize

§E — Drawing reference

Drawing	Shows	Scale
SHK-D4-P1-overall.svg	Side elevation, full body, hole positions	1:2
SHK-D4-P1-bore-section.svg	Section A-A through bore axis	1:2
SHK-D4-P1-utaguchi.svg	Utaguchi notch geometry, 32° bevel	4:1
SHK-D4-P1-hole-layout.svg	Unwrapped cylinder paper-wrap template	1:1
SHK-D4-P1-blank.svg	Pre-bore square stock	1:4
SHK-fixture-vise.svg	Tailstock vise welded fixture	1:2
SHK-fixture-hole-jig.svg	Tone-hole drill-press V-cradle jig	1:2

§F — Assembly manual

See `assembly-manual.md` for the full 13-step shop manual. The steps are:

1. Read first (design.md, risks.md, instrument-maker#84)
2. Mill blanks
3. Center-mark + cross-mark
4. Build tailstock vise (one-time)
5. Scrap-stock validation pass (mandatory)
6. Production deep-bore (the long one)
7. Outside turn
8. Tone-hole layout + drill undersize
9. Cut utaguchi
10. Bisque-style tuning (post-utaguchi)
11. Per-hole tuning
12. Octave check
13. Finish + record

§G — Validation / tuning sheet

(blanks for shop notes — see `validation.csv` for the full row set)

Stage	Target	Measured	Pass / Fail	Notes
Bore wander @ 6 in	< 0.020 in	_____	■	
Bore wander @ 12 in	< 0.040 in	_____	■	
Bore wander @ 18 in	< 0.080 in	_____	■	
Bore ID @ foot	0.787 ± 0.003	_____	■	
Bore ID @ mid	0.787 ± 0.005	_____	■	
Bore ID @ top	0.787 ± 0.005	_____	■	
Wall @ hole-4 station	≥ 0.150 in (any quadrant)	_____	■	
Ro fundamental	293.665 Hz ± 25 ¢ (pre-tune)	_____	■	
Ro fundamental	293.665 Hz ± 10 ¢ (post-tune)	_____	■	
Tsu (F4)	349.228 Hz ± 10 ¢	_____	■	
Re (G4)	391.995 Hz ± 10 ¢	_____	■	
Chi (A4)	440.000 Hz ± 10 ¢	_____	■	
Ri (C5)	523.251 Hz ± 10 ¢	_____	■	
Thumb (D5)	587.330 Hz ± 10 ¢	_____	■	
Octave Ro → Ro′	587.330 Hz ± 25 ¢	_____	■	
30-day drift	< 5 cents at 68 °F	_____	■	

Environment row (mandatory): Temp ____°F · RH ____% · tuner ____ · player ____

§H — Supplier RFQ summary

See `supplier-rfq.md` for the full RFQ. Headlines: 3 quarter-sawn cherry blanks, 20 mm reamer at 24 in OAL, deep-bore drill set, validation hardware, oil + wax finish supplies, hardware for fixtures.

§I — Visual BOM brief

A single-sheet (A3 landscape) plate with hero photo + tooling thumbnails + cost summary. See `visual-bom-brief.md` for the layout spec.

§J — Appendix

- Cross-references: instrument-maker#84 (deep-bore drilling), tonykoop/flutes (NAF K2 — do not port), tonykoop/fujara (long open-pipe sister), tonykoop/transverse-flute (open-pipe packet template).
- Cultural framing: Western adaptation in respect for Kinko-ry■ / Tozan-ry■ lineage; not a tradition-faithful reproduction.
- Empirical loop: `record_measurement.py` updates per-family `δ_utaguchi` correction; sibling packets read forward.