DESIGN GUIDELINE

Heat-Set Insert Design Guide

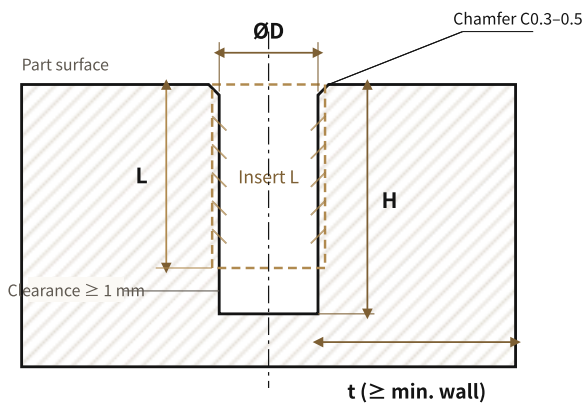
Knurled brass inserts are heat-pressed into 3D-printed parts with a soldering iron, so plastic parts can take metal screws again and again. Design your holes to this guide to keep inserts straight, flush and secure, and to shorten turnaround.

01 Size Chart

Thread	Insert OD D	Lengths L	Hole Ø ØD	Min. depth H ≥ L+1	Min. wall t	Center to edge min. e	Insert spacing min. p
M2 2 ODs	3.0	3	2.6	4	1.5	3.0	6.0
	3.2	2.5 / 3 / 4	2.8	3.5 / 4 / 5	1.5	3.0	7.0
M2.5	3.5	4 / 5	3.1	5 / 6	1.6	3.5	7.0
M3 2 ODs	4.6	5.7	4.0	6.7	1.8	4.0	10.0
	5.0	4 / 5 / 6	4.4	5 / 6 / 7	1.8	4.0	10.0
M4	6.0	4 / 6 / 8	5.3	5 / 7 / 9	2.2	5.0	12.0
M5	7.0	6 / 7 / 10	6.3	7 / 8 / 11	2.5	6.0	14.0
M6 2 ODs	8.0	8	7.3	9	3.0	7.0	16.0
	9.0	8	8.3	9	3.0	7.5	18.0
1/4"-20 tripod thread	8.0	12.7	7.3	13.7	3.0	7.0	16.0

Units: mm. Double-knurled brass inserts we stock; M2, M3 and M6 come in two ODs — size the hole for your insert, or ask us. Depth follows the chosen length (e.g. M3, OD 5.0, L 6 → depth ≥ 7); unspecified, we use the longest insert that fits.
Model holes at the recommended Ø — no shrinkage compensation needed; we fine-tune for special materials or tolerances.

02 Hole Cross-Section



- **ØD** Hole: straight, no draft, 0.4–0.7 mm under the insert OD; melted plastic grips the knurling.
- **H** Depth: blind holes at least **insert length + 1 mm** so melted plastic can flow and the insert seats fully.
- **L** Insert length: flush with the surface (0–0.2 mm recess allowed).
- **t** Wall: solid material from hole to outer edge; too thin bulges or cracks.
- **C** Chamfer 0.3–0.5 mm: easier alignment, no raised burr.

03 Design Tips

Hole orientation

- Keep the hole axis **perpendicular to a flat surface**; the iron presses straight down. On sloped or curved surfaces, add a flat landing.
- Leave **Ø ≥ insert OD + 6 mm, 15 mm high** of clearance above the hole so the iron tip can reach.
- Print holes facing up when possible — the walls come out roundest and most accurate.

Hole shape

- A **straight hole** is all you need — no taper. Blind holes may have a flat or conical bottom.
- Through holes are fine if the back is supported, or tell us how deep the insert should sit.
- No support material inside holes; reshape horizontal holes ≤ 10 mm so they print without supports.

Strength & spacing

- Keep wall thickness, center-to-edge and insert spacing at or above the values in section 01.
- For high loads or frequent disassembly, go one size up or choose a longer insert.
- Surround inserts with solid material or a thickened boss — not just a thin shell.

Marking

- Mark the **thread size and quantity** of every hole in the file or a drawing, e.g. "M3 × 8".
- If one part uses several sizes, distinguish them by color or number.
- Note any required insert length, brand, or a height other than flush.

04 Materials

Suitable **PLA／PLA+**	Most common; insert at about 200–220 °C with a high success rate. For parts exposed to heat for long periods (> 50 °C), use PETG or a higher-grade material.
Suitable **PETG**	Tough and crack-resistant; insert at about 230–245 °C.
Suitable **ABS／ASA／PC**	Heat-resistant with the strongest grip — ideal for mechanical and outdoor parts.
Suitable **PETG CF／PA CF**	Workable; carbon-fiber materials need hole tuning — please check with us first.
Not advised **TPU (flexible), resin parts**	Flexible material cannot hold inserts; cured resin does not soften with heat and cracks easily — heat-setting does not apply.

05 Print Settings

Applied automatically when we print

Walls & infill

- Wall loops: **at least 3–4**, so the area around the hole is solid.
- Infill: **25% or more**; 40%+ for load-bearing parts.
- Keep at least 1 mm of solid material below the hole bottom.

Troubleshooting

- **Tilted insert**: hole not perpendicular or not enough clearance — check orientation and space above.
- **Bulging or cracking**: wall or edge distance too small, or hole too small.
- **Insert spins or pulls out**: hole too large or not deep enough.

06 Process

1. **Send files or parts**: upload STEP/STL (holes modeled to this guide), or ship us printed parts.
2. **Mark holes and sizes**: list the thread size and quantity for each hole (an annotated screenshot is fine).
3. **Review**: we check hole size, depth and walls against this guide and suggest changes if needed.
4. **Install & inspect**: each insert is heat-pressed, checked for straightness and flushness, and test-fitted with a screw.
5. **Pack & ship**: convenience-store pickup (Taiwan), home delivery, or studio pickup.

07 Pre-Submission Checklist

- ☐ Holes modeled at the recommended diameter (section 01)
- ☐ Wall, center-to-edge and spacing meet the minimums
- ☐ 0.3–0.5 mm chamfer, no supports inside holes
- ☐ Thread size and quantity marked for every hole
- ☐ Blind hole depth ≥ insert length + 1 mm
- ☐ Hole axis perpendicular, iron clearance above
- ☐ Material suits heat-setting (not TPU or resin)
- ☐ Special length, brand or height noted separately

Questions about your design? Send it over

Share a file or screenshot and we will check the holes and insert sizes

LINE @262qoysi
Email support@apexionstudio.com
Web www.apexionstudio.com