DESIGN GUIDELINE

# Screw & Nut Hole Design Guide

When 3D-printed parts are assembled with screws, the hole size decides whether the screw goes in and whether it strips. Model the clearance holes, counterbores and nut pockets to this guide so screw heads and nuts sit flush and the parts go together the first time.

01 · SIZE CHART

## Size chart

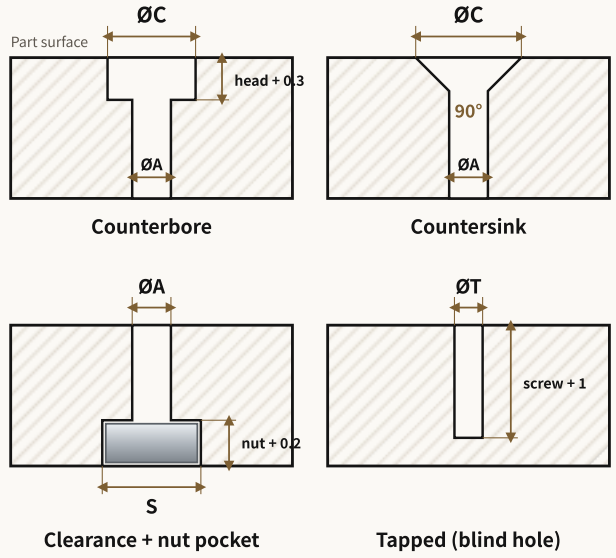
| Thread pitch | Clearance hole screw passes | Tapped into plastic screw bites | Socket head counterbore dia. × depth | Flat head countersink 90°, top dia. | Hex nut pocket across flats × depth | Hex key socket head |
|---|---|---|---|---|---|---|
| M1.6 0.35 | 1.8 | 1.4 | 3.6 × 1.9 | — | — | 1.5 |
| M2 0.4 | 2.4 | 1.7 | 3.6 × 2.3 | 4.4 | 4.3 × 1.7 | 1.5 |
| M2.5 0.45 | 2.9 | 2.1 | 4.4 × 2.8 | 5.4 | 5.3 × 2.1 | 2 |
| M3 0.5 | 3.4 | 2.6 | 6.1 × 3.3 | 6.1 | 5.8 × 2.4 | 2.5 |
| M3.5 0.6 | 3.9 | 3 | — | — | 6.3 × 3 | — |
| M4 0.7 | 4.5 | 3.4 | 7.6 × 4.3 | 8.4 | 7.3 × 3 | 3 |
| M5 0.8 | 5.5 | 4.3 | 9.1 × 5.3 | 10.4 | 8.3 × 3.7 | 4 |
| M6 1 | 6.6 | 5.1 | 10.6 × 6.3 | 12.4 | 10.3 × 5.2 | 5 |
| M8 1.25 | 9 | 6.8 | 13.6 × 8.3 | 16.4 | 13.3 × 6.7 | 6 |
| M10 1.5 | 11 | 8.6 | 16.6 × 10.3 | 20.4 | 17.3 × 8.2 | 8 |
| M12 1.75 | 13.5 | 10.3 | 18.6 × 12.3 | 24.4 | 19.3 × 10.2 | 10 |

Unit: mm. Clearance holes follow ISO 273 (medium). Tapped hole = thread diameter − pitch + 0.1. Counterbore = head diameter + 0.6, depth = head height + 0.3. Countersink = head diameter + 0.4 (90°). Nut pocket = across flats + 0.3, depth = nut thickness + 0.2. Head and nut sizes are those of the stainless screws and nuts we sell (same as in our shop); sizes we do not sell (grey) use standard values.

Model the holes with these values directly; no shrinkage compensation needed. For larger runs or tight fits, print a test hole first.

02 · CROSS SECTION

# Cross section




- **ØA** Clearance hole: the screw passes through freely. When two parts are clamped together, the part under the screw head gets the clearance hole.
- **ØC** Counterbore: lets a socket head sit flush; depth = head height + 0.3. Flat head screws need a 90° countersink, top diameter = head diameter + 0.4.
- **S** Nut pocket: hexagonal, across flats = nut + 0.3, depth = nut thickness + 0.2, so the nut cannot turn.
- **ØT** Tapped hole: smaller than the screw, which cuts its own thread in the plastic. Make it at least screw length + 1 mm deep.

03 · METHODS

# Choosing a fastening method

01 **Screw directly into plastic**: Simplest, no extra parts. Fine for joints that are rarely taken apart; PLA threads wear out after a few cycles.

02 **Heat-set insert**: A brass insert pressed in with heat: reusable threads and good strength, ideal for housings and lids that are opened often. See the Heat-Set Insert Design Guide.

03 **Nut**: A hex nut on the back side: the strongest option for high loads. Needs space behind the part or a nut pocket.

04 · DESIGN TIPS

# Design tips

## Hole orientation

- Print holes **perpendicular to the bed** (facing up) for the roundest, most accurate holes.
- Horizontal holes sag at the top: use a **teardrop (pointed) top** for small holes, or add 0.2 mm to the diameter.
- Counterbores and nut pockets facing up need no supports; facing down, leave room to remove supports.

## Nut pockets

- Side-entry pocket: a slot as wide as across flats + 0.3 lets you slide the nut in from the side.
- Print-in: pause at the top of the pocket, drop the nut in and resume; it is fully enclosed (mention it when you request a quote).
- Keep at least 1.5 mm of solid wall around the pocket so it does not crack when tightened.

## Screw length

- Through a nut: length ≈ clamped thickness + nut thickness + 2–3 threads.
- Screwing into plastic: engage at least 2 × the screw diameter (e.g. 6 mm for M3).
- Flat head screw length includes the head; socket head screw length does not.

## Strength & tightening

- Make the material around holes solid or add a boss; use at least 3–4 walls.
- Tighten until snug, not more; cracked or stripped plastic cannot be repaired.
- For joints that are opened often or carry high loads, use heat-set inserts or nuts.

05 · MATERIALS

# Materials

| | | |
|---|---|---|
| Good | **PLA / PLA+** | Fine for clearance holes, counterbores and nut pockets; screwing directly works but strips after repeated assembly. |
| Good | **PETG** | Tough; threads cut directly into PETG last longer than in PLA. |
| Good | **ABS / ASA / PC** | Strong and heat-resistant, good for mechanisms and parts that are assembled often. |
| Good | **Resin (SLA)** | Brittle; screwing directly may crack it. Use clearance holes with nuts, or ask us about inserts. |
| Caution | **TPU (flexible)** | Too soft to hold a screw tight; use a clearance hole with a nut, or keep rigid parts separate. |

06 · CHECKLIST

# Checklist before sending

- [ ] Hole sizes taken from the chart (clearance or tapped)
- [ ] Tapped holes are at least screw length + 1 mm deep
- [ ] Holes print facing up; horizontal holes have a teardrop top or extra 0.2 mm
- [ ] Screw size and quantity marked for every hole, e.g. "M3 × 10 × 4"
- [ ] Counterbores, countersinks and nut pockets include the allowance
- [ ] Enough solid material around holes and nut pockets
- [ ] Joints opened often use heat-set inserts or nuts
- [ ] Noted if you want us to supply the screws and nuts or assemble the parts

## Questions about your design? Send it to us first

Attach your file or a screenshot and we will check the holes and screw sizes

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