

ENGINEERING SPECIFICATION

SHIFT KNOB BASE WITH ADHESIVE-BONDED METAL THREADED INSERT

1. PART OVERVIEW

Part Name: Shift Knob Base for Ø50 mm Resin Dome

Application:
A structural plastic base designed to support a finished Ø50 mm resin dome and accommodate a separate metal threaded insert bonded into a dedicated pocket from the bottom.

Material and Manufacturing Options — Quote Separately:

- Option A:** ABS or PC (Polycarbonate), CNC machined.
- Option B:** PA12 (Nylon), 3D printed using MJF or SLS.

POM is not an approved material option for this project.

The supplier shall identify the exact material grade, manufacturing process, and any required post-machining in each quotation.

Units: All dimensions are in millimeters unless otherwise specified.

2. OVERALL DIMENSIONS

Feature	Specification
Overall height	45.00 mm
Maximum outside diameter	Ø55.00 mm
Lower stem diameter	Ø20.00 mm
Nominal lower stem height	Approximately 15.00 mm
Resin dome nominal diameter	Ø50.00 mm
Top cavity inside diameter	Ø50.50 mm
Top cavity depth	12.00 mm
Nominal top rim radial thickness	2.25 mm
Bottom insert pocket total depth	24.00 mm
Remaining material thickness between cavities	9.00 mm nominal

The external profile above the lower stem shall transition smoothly toward the upper body.
The supplier shall show the final external profile in the updated 2D manufacturing drawing and 3D CAD model.

3. EXTERNAL PROFILE

The lower section shall retain a straight cylindrical stem:

- Nominal stem diameter: Ø20.00 mm
- Nominal stem height: approximately 15.00 mm from the bottom face

Above the stem, the external profile shall transition smoothly outward toward the upper body.

5. BODY MATERIAL AND MANUFACTURING OPTIONS

The supplier shall provide separate quotations for the following options.

Option A — ABS or PC, CNC Machined

- **Material:** ABS or PC (Polycarbonate).
- **Manufacturing process:** CNC machining.
- State the exact material grade in the quotation.
- Machine all critical cavity and insert-pocket dimensions to the approved drawing.
- Deburr all functional edges without changing critical dimensions.
- Confirm that the selected material is compatible with the proposed epoxy adhesive and cleaning process.

ABS and PC shall be quoted as separate material alternatives if both are available.

Option B — PA12 Nylon, MJF/SLS 3D Printed

- **Material:** PA12 Nylon.
- **Manufacturing process:** MJF or SLS 3D printing.
- State the printing process and exact material grade in the quotation.
- Critical insert-pocket dimensions shall be post-machined if required to achieve the specified dimensions and clearances.
- The finished part shall be free from cracks, delamination, and significant manufacturing defects.
- Confirm that the selected PA12 grade and surface condition are suitable for the proposed epoxy adhesive.

No material or manufacturing-process substitution is permitted without written approval.

6. BOTTOM METAL INSERT POCKET

The mounting thread shall be provided by a separate metal insert nut bonded into the bottom of the plastic body. The plastic body itself shall not have a directly machined 3/8-24 UNF mounting thread.

6.1 Metal Insert Reference Dimensions

Overall insert length	23.00 mm
Flange outside diameter	Ø15.00 mm
Flange thickness	4.00 mm
Insert body outside diameter	Ø12.00 mm nominal
Insert body length below flange	19.00 mm
Internal thread	3/8-24 UNF-2B
Minimum full usable thread depth	20.00 mm
Knurling	Retain the approved insert design

The approved metal insert drawing shall govern the actual insert geometry. The supplier shall verify the maximum outside diameter over the knurling. The specified body-pocket clearance shall be checked against the actual maximum insert diameter, not only the nominal Ø12.00 mm body diameter.

6.2 Insert Pocket Dimensions

The insert pocket shall be formed from the bottom face of the base.

7. ADHESIVE BONDING — NO PRESS FIT

The metal insert shall be secured by manual adhesive bonding using a suitable commercially available epoxy adhesive. **Press-fitting, force-fitting, or interference-fitting the metal insert into the plastic body is not permitted.**

The following pocket dimensions shall be maintained (providing 0.20 mm diametral clearance):

- **Flange counterbore:** Ø15.20 mm × 4.00 mm deep
- **Insert body pocket:** Ø12.20 mm × 20.00 mm deep

The pocket dimensions are intended to permit adhesive application and insertion without excessive mechanical stress on the plastic body. The insert shall be installable without wedging, excessive force, cracking, splitting, or permanent deformation of the plastic.

The supplier shall not reduce the specified pocket clearances without written approval.

7.1 Adhesive Compatibility & 7.2 Surface Preparation

The proposed adhesive shall be compatible with the metal insert material, selected body material (ABS, PC, or PA12), and intended service loads.

- Remove oil, grease, dust, and loose particles from all bonding surfaces.
- Use a cleaning method approved by the material and adhesive manufacturers. Do not use aggressive solvents on PC unless expressly approved.
- Allow cleaned surfaces to dry completely before applying adhesive. Avoid touching with bare fingers.

7.3 Manual Assembly and Curing

The assembly shall be designed for manual insertion of the metal insert with adhesive without requiring a press-fit operation. Follow the adhesive manufacturer's specified mixing ratio, working time, assembly time, and curing parameters. The insert shall be held in the correct axial position and alignment during curing; it shall not float upward, tilt, or rotate.

8. AIR BLEED / VENT GROOVE

One longitudinal air-bleed groove shall be provided in the side wall of the Ø12.20 mm insert body pocket to allow trapped air and excess adhesive to escape during insertion.

Quantity	1 groove
Orientation	Longitudinal, parallel to the main body axis
Width x Depth (Nominal)	1.0 mm wide × 0.5 mm deep
Permitted initial design range	Width 1.0–2.0 mm; depth 0.5–1.0 mm

Unless otherwise approved, use the lower end of the specified range (1.0 x 0.5 mm). The groove shall extend continuously along the full 20.00 mm depth and communicate with the flange counterbore. It shall **not** extend through the remaining structural floor into the top resin dome cavity.

Manufacturing Requirements: The groove shall have clean edges, free from burrs. The supplier shall show the groove clearly in 2D/3D models and confirm manufacturability.

9. CRITICAL STRUCTURAL FLOOR THICKNESS

The nominal remaining material thickness between the top cavity floor and the bottom insert pocket is:
 $45.00 - 12.00 - 24.00 = 9.00 \text{ mm}$

REQUIRED REMAINING FLOOR THICKNESS: 9.00 mm (NOMINAL)

11. SURFACE FINISH AND APPEARANCE

The finished component shall have a clean, uniform industrial engineering-plastic appearance.

- External surfaces shall be smooth and visually consistent.
- Remove loose particles, burrs, and sharp edges.
- No cracks, delamination, severe voids, or significant surface defects are permitted.
- The resin dome seating surface and insert pocket/vent groove shall be clean and suitable for bonding.
- Avoid excessive sanding or polishing that changes critical dimensions.

For CNC-machined ABS or PC, clean and consistent machining marks are acceptable. For PA12 MJF/SLS parts, uniform manufacturing texture is acceptable if it does not compromise fit, strength, or bonding.

12. EDGE BREAK AND DEBURRING

All non-functional sharp edges shall be lightly deburred. The top cavity entrance shall be free from burrs that could damage the resin dome. The insert-pocket entrance shall allow manual installation without catching. Do not apply excessive chamfers that reduce required seating surfaces or rim/floor thickness.

13. CRITICAL DIMENSION SUMMARY

Feature	Required Specification
Overall height	45.00 mm
Maximum outside diameter	Ø55.00 mm
Lower stem diameter	Ø20.00 mm
Nominal lower stem height	Approximately 15.00 mm
Top cavity diameter	Ø50.50 mm
Top cavity depth	12.00 mm
Top cavity floor level	Z = 33.00 mm
Nominal top rim radial thickness	2.25 mm
Total bottom insert pocket depth	24.00 mm
Flange counterbore	Ø15.20 × 4.00 mm deep
Insert body pocket	Ø12.20 × 20.00 mm deep below flange seat
Vent groove	1.0 mm wide × 0.5 mm deep nominal (Qty: 1)
Nominal remaining structural floor	9.00 mm
Insert internal thread	3/8-24 UNF-2B
Minimum full usable insert thread depth	20.00 mm
Side access/locking holes	Not permitted

The final manufacturing drawing shall specify tolerances for all critical dimensions to preserve dome fit, pocket clearances, and structural integrity.

14. MANUFACTURING & 15. SUPPLIER DELIVERABLES