

Shaft Assembly Project

Mechanical Shaft

Project Report

DATE:

January 25, 2026

Submitted By:

Frais Asghar

CMS ID: 516900

ME-16(Section-A)



Shaft Assembly Project

1. Project Overview

This project involves comprehensive CAD modeling and technical analysis of a stepped mechanical shaft and its integrated support bracket. The design was executed to meet specific geometric constraints and engineering standards, focusing on functional assembly and structural integrity.

2. Objectives

The primary objectives of this design project were:

- ❖ **Precision Modeling:** To develop a high-fidelity 3D model of a mechanical shaft with varying diameters and stepped sections.
- ❖ **Technical Interpretation:** To accurately translate complex orthographic dimensions into a 3D isometric representation.
- ❖ **Design for Assembly (DFA):** To ensure proper tolerance and alignment between the shaft and the green support housing.
- ❖ **Geometric Fidelity:** To apply specific radii ($R15.0, R17.5$) and hole diameters ($\emptyset 10.0, \emptyset 60.0$) as dictated by engineering specifications.

3. Component Analysis

3.1 Stepped Mechanical Shaft

The shaft is the primary rotating or load-bearing element. It features:

- ❖ **Flange Section:** A $\emptyset 60.0$ mounting flange that interfaces with the support bracket.
- ❖ **Transition Zones:** Smooth transitions between sections to reduce stress concentration.
- ❖ **Keyed/D-Cut Profile:** A functional end section with an $R17.5$ radius and a 7.5 mm offset flat surface, designed for torque transmission or specific orientation.
- ❖ **Dimensional Accuracy:** Total functional length measured at 145.0 mm, with sub-sections of 105.0 mm and 64.0 mm.



3.2 Support Bracket

The green support component serves as the stationary base:

- Hole Geometry:** Includes two $\varnothing 10.0$ mounting holes positioned with a 74.0 mm span.
- Structural Support:** Features a 75.8 mm height with a central bore to accommodate the 52.0 mm hexagonal/rounded interface of the shaft.

4. Technical Specifications

Feature	Dimension (mm)
Main Flange Diameter	$\varnothing 60.0$
Support Hole Spacing	74.0 (Center-to-Center)
Shaft Total Length	145.0
Support Height	75.8
End Radius	$R17.5$
Flat Surface Offset	7.5

5. Design Methodology

The development process was conducted through the following stages:

- Drafting & Sketching:** Initial 2D profiles were created for the support bracket and the shaft cross-sections.
- Extrusion & Revolution:** The bracket was created via linear extrusion, while the shaft utilized both revolutionary and additive extrusion techniques.
- Refinement:** Fillets and radii ($R15.0$ on the bracket corners) were applied to ensure ergonomic handling and mechanical durability.
- Verification:** A final check of the 37.0 mm, 38.2 mm, and 43.0 mm clearance dimensions was performed to confirm assembly fitment.



6. Engineering Considerations

- **Stress Distribution:** Use of rounded corners on the support bracket to prevent cracking under vibration.
- **Manufacturability:** The shaft design is optimized for lathe operations followed by a milling process for the flat end section.
- **Material Efficiency:** Geometry suggests a balance between weight reduction and torsional rigidity.

7. Conclusion

This project successfully demonstrated the application of advanced CAD modeling techniques to solve mechanical design challenges. By strictly adhering to the 1 : 1 dimensional requirements, the resulting model serves as a production-ready representation of a mechanical assembly. This experience has significantly strengthened my proficiency in SolidWorks/AutoCAD and my understanding of real-world mechanical tolerances.