**Design for Clampability & Accessibility**

Proper **clampability** and **accessibility** in design ensure efficient manufacturing, assembly, and maintenance by reducing setup time, improving workpiece stability, and simplifying tool access.

**1. Design for Clampability**

**A. Why Clampability Matters?**

✔ Ensures **secure holding** of the workpiece during machining.
✔ Reduces **vibration and deflection**, improving precision.
✔ Enhances **safety** and prevents part movement during processing.

**B. Key Design Guidelines for Clampability**

✔ **Flat Surfaces for Clamping** → Provide at least **two flat, parallel surfaces** for stable clamping.
✔ **Minimize Overhangs** → Overhangs >3× thickness increase vibration and reduce accuracy.
✔ **Use Standard Workholding Features** → Include **slots, holes, or bosses** to fit standard clamps or vises.
✔ **Avoid Interference with Clamping Areas** → Keep functional features away from clamping zones.
✔ **Provide Extra Stock for Clamping** → Add **0.5 – 1.0 mm** excess material on non-critical areas for secure gripping.

**C. Recommended Workpiece Clamping Considerations**

| **Feature** | **Best Practices** |
| --- | --- |
| **Thin Walls** | Increase thickness or use support ribs |
| **Cylindrical Parts** | Use soft jaws or V-blocks |
| **Irregular Shapes** | Design with locating holes for fixtures |

**2. Design for Accessibility**

**A. Why Accessibility Matters?**

✔ Improves **ease of assembly, disassembly, and maintenance**.
✔ Reduces **labor time and tool maneuvering issues**.
✔ Allows for **efficient machining, welding, and inspection**.

**B. Key Design Guidelines for Accessibility**

✔ **Provide Adequate Tool Clearance** → Maintain **at least 1.5× tool diameter** space around fasteners.
✔ **Avoid Deep, Hard-to-Reach Features** → Limit depth of **pockets and recesses** for easy access.
✔ **Standardize Fastener Orientation** → Align bolts/nuts in the **same direction** for faster assembly.
✔ **Use Quick-Access Fasteners** → Prefer **snap-fits, clips, or quarter-turn fasteners** over screws.
✔ **Optimize Component Placement** → Place components for **easy reach by human hands or robotic arms**.

**C. Recommended Minimum Access Clearances**

| **Operation** | **Minimum Clearance** |
| --- | --- |
| **Bolt tightening (wrench)** | **1.5× bolt head size** |
| **Screwdriver access** | **2× screw head diameter** |
| **Hand clearance for assembly** | **≥100 mm** |