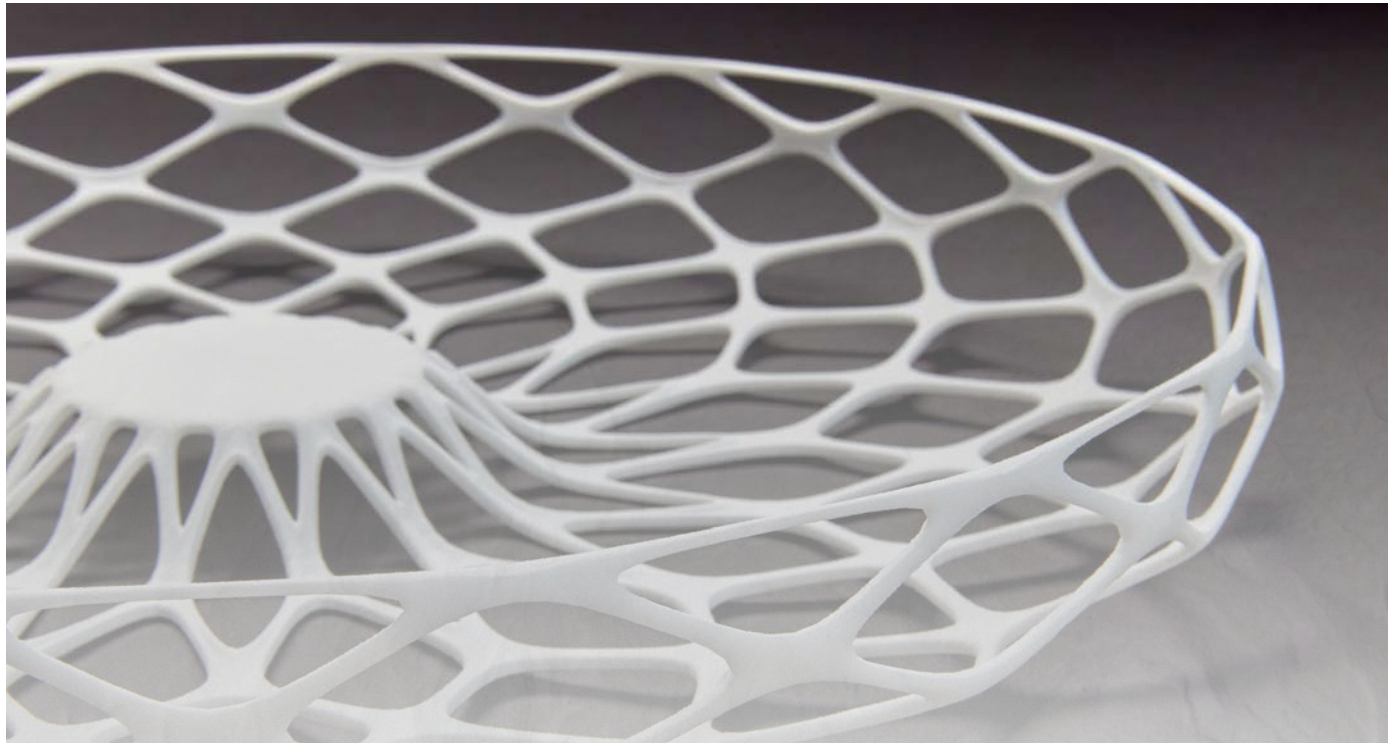




realize the unrealistic

NW RAPID MANUFACTURING

Selective Laser Sintering (SLS) Basic Design Guidelines



This guide delivers the essentials for Selective Laser Sintering (SLS)—covering material selection, design constraints, file preparation, and printing best practices.

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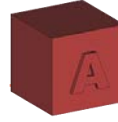
Selective Laser Sintering Basic Design Guidelines

1. TEXT FEATURES



Recessed Text

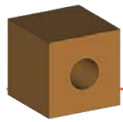
- ✔ **Font Choice:** Use a clean, legible **sans-serif font** (e.g., Arial).
- ✔ **Styling:** Always apply **Bold** to keep the printed geometry strong.
- ✔ **Font Size:** Keep it at or above **16 pt.** Bigger yields cleaner results.
- ✔ **Engraving Depth:** For smaller text (16 pt), depth must be at least **0.8 mm** to prevent details from filling in with powder. For larger text, depth can be as shallow as **0.5 mm**.



Raised Text

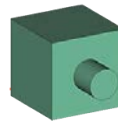
- ✔ **Font Choice:** Choose a clean **sans-serif font** (e.g., Arial).
- ✔ **Styling:** Always apply **Bold** to ensure the geometry bonds correctly during the laser build.
- ✔ **Font Size:** Stay at or above **14 pt.**
- ✔ **Embossing Height:** Keep the height to at least **0.6 mm** so the details stand out clearly from the surface.

2. MECHANICAL & GEOMETRIC FEATURES



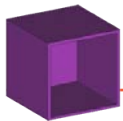
Holes

- ✔ **Vertical Build Orientation:** Minimum **1.5 mm** diameter.
- ✔ **Horizontal Build Orientation:** Minimum **2.0 mm** diameter.
- ✔ **DESIGN NOTE:** For maximum resolution, orient the part so critical holes build vertically and minimize the part thickness in that specific area.



Pins

- ✔ **Minimum Diameter:** **1.0 mm** required for both vertical and horizontal orientations.
- ✔ **Clearances for Moving/Hinge Pins:**
 - ▶ **X-Y Build Plane:** Minimum **0.3 mm** per side.
 - ▶ **Z Build Axis:** Minimum **0.5 mm** per side.
Adjust your hole or pin diameter to accommodate this variation.



Thin Walls

- ✔ **Guaranteed Minimum:** **1.0 mm.** Anything thinner is handled strictly on a “**best effort**” basis.
- ✔ **Recommended Minimum:** **1.5 mm** to ensure predictable mechanical properties and precise measurements.
- ✔ **Orientation:** Position thin walls plane-by-plane during setup to improve accuracy and detail resolution.



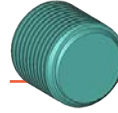
Selective Laser Sintering Basic Design Guidelines

3. MECHANICAL COMPONENTS



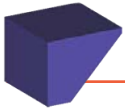
Gears

- 👉 **Shaft Clearance:** Increase to a minimum of **1.0 mm** for free-spinning gears.
- 👉 **Tooth Separation:** Space teeth between **0.5 mm and 1.0 mm** apart.
- 👉 **PROCESS NOTE:** Apply all geometric changes to your model **BEFORE** exporting the final STL file.



Threads

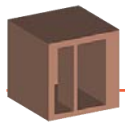
- 👉 **Printed Threads:** Increase the thread clearance by a minimum of **0.1 mm**.
- 👉 **Machined Threads:** For optimal performance, we highly recommend adding threads via a post-op tapping process or inserts.
- 👉 **PROCESS NOTE:** Apply all geometric changes to your model **BEFORE** exporting the final STL file.



Feathered Edges

- 👉 **Taper Limit:** Tapered or knife edges must stop at a minimum thickness of **0.8 mm**.
- 👉 **DESIGN WARNING: DO NOT** taper down to a true sharp edge. They are highly fragile and prone to breaking during powder removal and post-processing.

4. WALL THICKNESS & LARGE GEOMETRIES



Wall Thickness Optimization

- 👉 **The Sweet Spot:** Aim for a consistent nominal wall thickness between **1.5 mm and 3.0 mm**.
- 👉 **Consistency:** Keep your wall nominals uniform. Massive blocks of material trap excess heat, causing extreme shrinkage, part distortion, and warping.
- 👉 **Internal Features:** Keep internal or external ribs, gussets, and baffles under **60%** of the thickness of their adjoining wall to prevent sink marks.



Bosses

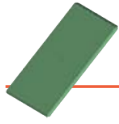
- 👉 **Outside Diameter:** Make the OD 2x to 3x the diameter of the insert to add strength and counter hoop shrinkage (sidewall deformation).
- 👉 **Boss Height:** Match the boss height exactly to the insert height. Excess height causes localized cooling shrinkage and structural weakness below the boss line.
- 👉 **Supporting Features:** Ribs and gussets add excellent structural integrity. Keep their thickness under 60% of the boss sidewall thickness to avoid heat concentration.

4. WALL THICKNESS & LARGE GEOMETRIES
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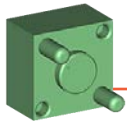
4. WALL THICKNESS & LARGE GEOMETRIES (CONTINUED)



Large Flat Parts (Warping Mitigation)

- Warping Risk:** Large flat areas are inherently prone to warping. Severity depends on wall thickness, surrounding geometry, and overall footprint.
- Material Selection:** Use a filled material (like carbon-filled nylon) to significantly reduce warping.
NOTE: *Filled materials reduce warping substantially but will not completely eliminate it.*
- Sacrificial Frames:** Design a space frame or grid around the part. This grid can be cut and sanded off after delivery to help maintain flatness during cooling.

5. TOLERANCES & PRODUCTION MANUFACTURING



Standard Production Tolerances

- Symmetric Only:** The SLS process can only accommodate symmetric tolerances.
- High Volume / Strict Specs:** For large production runs or massive parts with strict tolerance requirements, leave extra stock on the CAD model for post-op machining.
- Prototype Runs (≤ 10 parts):** Submit your native 3D CAD file with your request. This allows us to fine-tune the model geometry to account for specific material shrink rates.
- RFQ Submission:** Please explicitly highlight critical dimensions and required tolerances on a print when submitting your Request for Quote (RFQ).

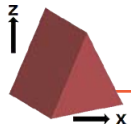
FEATURE SIZE	STANDARD SLS TOLERANCE
≤ 50 mm	± 0.25 mm
51 mm to 75 mm	± 0.38 mm
≤ 75 mm	± 0.38 mm + 0.05 mm for every 25 mm over 75 mm

(Applies to parts with no post-op machining)



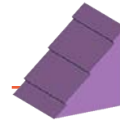
Selective Laser Sintering Basic Design Guidelines

6. PROCESSING & FINISHING



Build Orientation

- 🐦 **Standard Default:** Unless specified otherwise, parts are oriented with the shortest dimension along the **Z-axis**.
- 🐦 **Custom Alignment:** If your application requires a specific orientation, include a print with your RFQ detailing the preferred X-Y-Z alignment and explicit Z-growth direction.



Layer Lines

- 🐦 **Surface Texture:** Because SLS builds parts layer by layer, curved and angled surfaces will show subtle step lines.
- 🐦 **Orientation Strategy:** To get a smoother finish, request that the critical surface be oriented facing downward in the build window. Print critical surfaces at either 0° degrees (perfectly horizontal) or at angles greater than 20° degrees.
- 🐦 **Finishing:** Standard post-op processes like tumbling or manual sanding easily smooth out remaining layer lines.

7. SPECIAL FEATURE: LIVING HINGES



Living Hinge Best Practices

- 🐦 **Recommendation:** Avoid living hinges in SLS if your design allows.
- 🐦 **Best Material:** If required, you must use **Nylon 11 (PA 850 Black)**.
- 🐦 **Hinge Thickness:** Minimum **0.8 mm**.
NOTE: *This is below our guaranteed 1.0 mm minimum wall thickness, so it is built strictly as a “best effort” feature.*
- 🐦 **Conditioning Protocol:** You must anneal the hinge before flexing it. Submerge the part in boiling water for 10 minutes, then let it cool slowly.
WARNING: *This step can cause slight dimensional changes or deformation to other tight-tolerance features on your part.*

Performance Expectations:

- 🐦 The hinge will flex, but it will not behave like an injection-molded plastic.
- 🐦 Expect the hinge to fatigue and break after a limited number of cycles. Over-flexing will cause immediate failure.
- 🐦 The longer you can design the hinge, the better your chance of functional success.



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NORTHWEST RAPID MANUFACTURING

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Post Processing and Finishing | Design and Engineering Services
Design Consultation for Additive Mfg.

SLS PRINTERS – PRINTER CHAMBER SIZE AND THICKNESS

P730 / P760: 700 x 380 x 580 mm (27.5" x 14.9" x 22.8") – **P730:** 0.12 mm / **P760:** 0.06-0.10-0.12-0.15-0.18 mm
P390: 340 x 340 x 620 mm (13.3" x 13.3" x 24.4") – 0.1-0.15 mm
