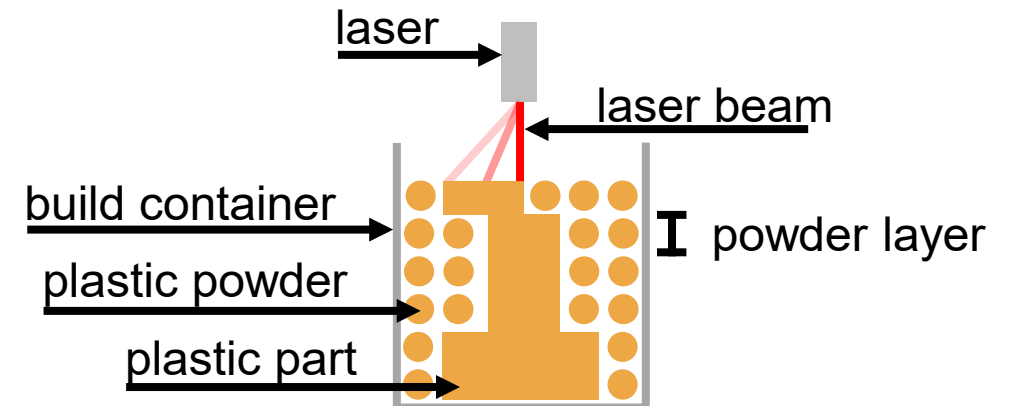


Construction Guidelines SLS

January 2024

Selective Laser Sintering (SLS)

- SLS is a 3D-printing process, where plastic powder is locally melted, layer by layer with a laser, to form the finished component
- Complex geometries, for example with undercuts, can be easily produced by using the SLS technology

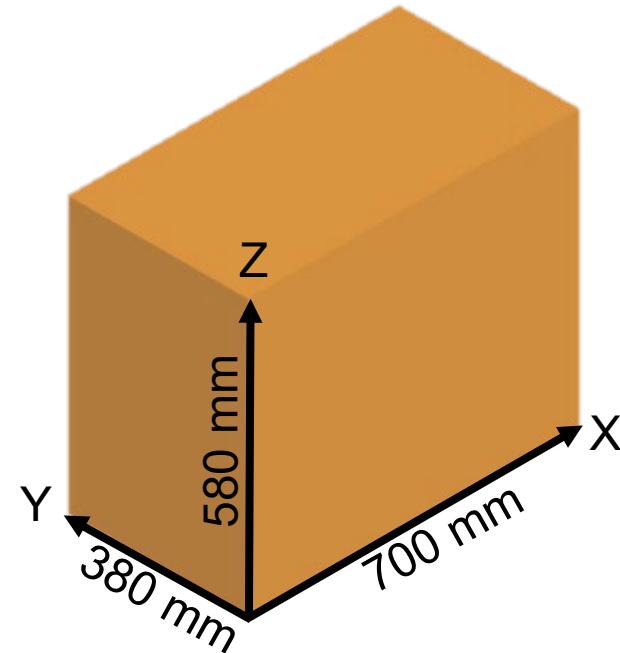


Maximum Component Dimensions

- Maximum possible component dimensions:

$$X \times Y \times Z = 700 \times 380 \times 580 \text{ mm}$$

- Drill holes and cylindrical geometries such as pins should be produced in the Z-direction if possible

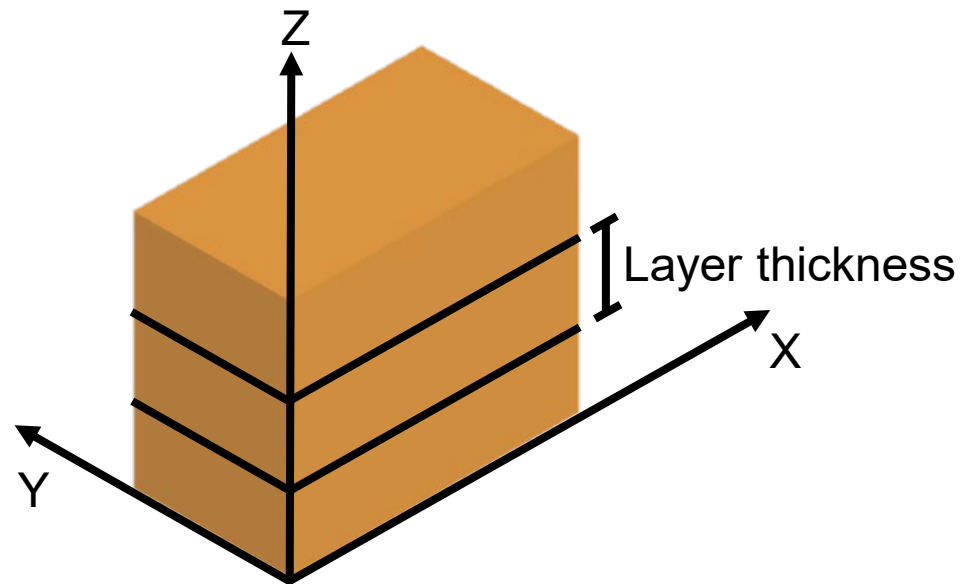


Material Variety

| Material | Composition | Colour | Features |
|------------|-------------------------------|---------------|--|
| PA 2200 | PA 12 | white | Multipurpose material, Balanced material properties, Good strength, Good stiffness, Good chemical resistance, Suitable for food contact |
| PA 2201 | PA 12 | translucent | Multipurpose material, Balanced material properties, Good strength, Good stiffness, Good chemical resistance, |
| PA 3200 GF | PA 12 filled with glass balls | white | High stiffness, Good elongation at break, High wear resistance, Improved temperature property profile compared to PA 2200 |
| Alumide | PA 12 filled with aluminium | metallic grey | High stiffness, Very high temperature resistance, Dimensional stability at high temperatures, Improved temperature property profile compared to PA 2200, Easy to rework (good machinability and grindability) |
| PA 2241 FR | PA 12 with flame retardant | white | With halogencontaining flame retardant, Good tensile strength, Good stretchability, Refresh optimised material, Suitable for use in the aviation industry |
| PA 2210 FR | PA 12 with flame retardant | white | With halogenfree chemical flame retardant, Fire protection class UL 94 / V-0 fulfilled from 3 mm wall thickness onwards, Suitable for use in the aerospace industry and in the electrical and electronics industry |
| PA 1101 | PA 11 | white | Multipurpose material, Balanced material properties, High ductility, High impact strength, High breaking strength, Shatterproof in case of breakage, More temperature resistant than PA 12, Based on renewable raw materials |
| TPU 1301 | TPU | white | High resilience after deformation, Good hydrolysis resistance, High UV stability |

Layer Thickness

- We always manufacture with the ideal layer thickness for your component and material
- Generally, we manufacture with layer thicknesses of 100 μm , 120 μm or 150 μm



Wall Thickness /Pin Diameter

- The minimum wall thickness (X-, Y- and Z-direction) is approximately 0.8 mm
- The minimum diameter of a cylindrical pin is approximately 0.8 mm
- For repeatable measurements and mechanical properties, the minimum wall thickness is approximately 1.5 mm and the minimum pin diameter is approximately 1.8 mm

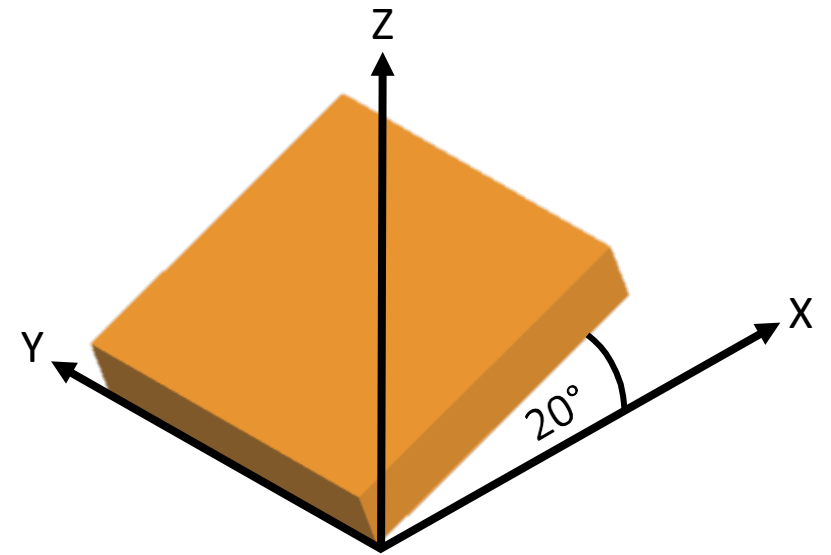
Drill Holes

- For each wall thickness, there is a minimum diameter for a drill hole that can be produced directly in the SLS process
- The following table can be used as an orientation:

| Wall thickness | Minimum diameter |
|----------------|------------------|
| 0.5 to 0.6 mm | 0.8 mm |
| 0.6 to 1.0 mm | 0.9 mm |
| 1.0 to 1.8 mm | 1.1 mm |
| 1.8 to 2.4 mm | 1.2 mm |
| 2.4 to 4.0 mm | 1.5 mm |
| 4.0 to 6.0 mm | 1.8 mm |

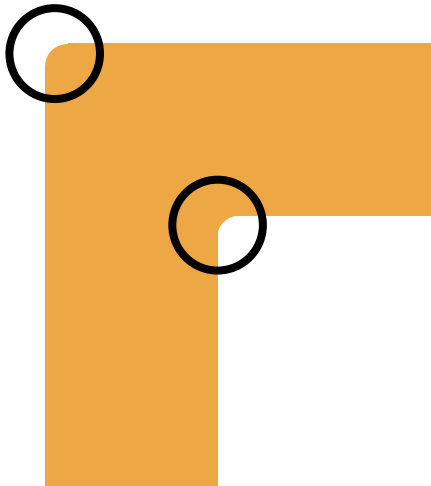
Visibility Of The Single Layers

If the surface of a component is inclined by 20° or less in relation to the XY-plane, the single layers on the surface of the component are visible



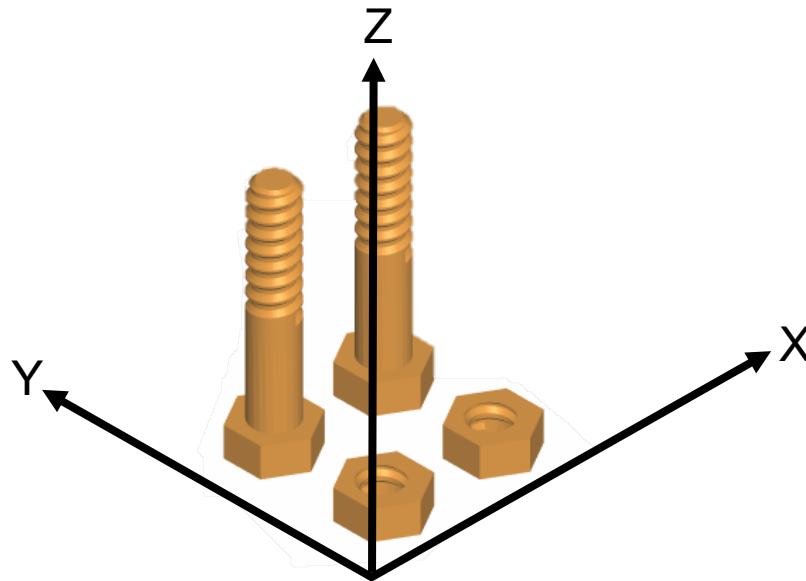
Corners And Edges

- Sharp corners and edges are not manufacturable
- If possible, use a minimum radius of 0.3 mm at corners and edges



Threads

- Internal and external threads can be produced from a size of M10 if they are manufactured in Z-direction
- For smaller threads, thread inserts should be pressed in



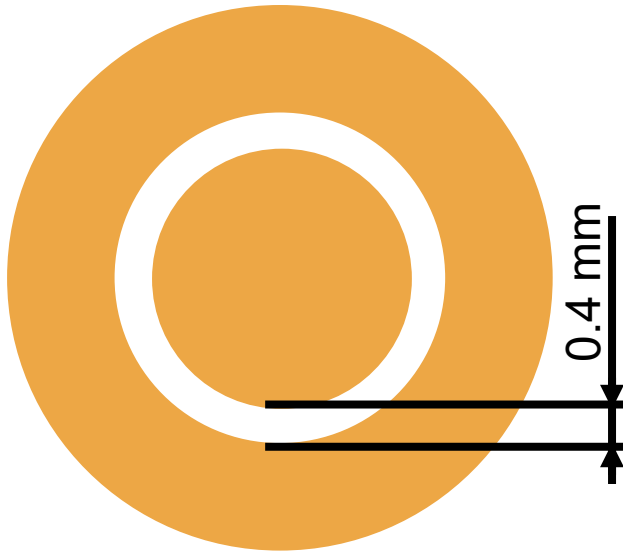
Loose Connection /Press Fit

- A gap of 0.1 mm between a male and female component creates a loose connection
- No gap between a male and female component creates a press fit
- This only applies to components that are assembled after the manufacturing process (otherwise see joints)



Joints

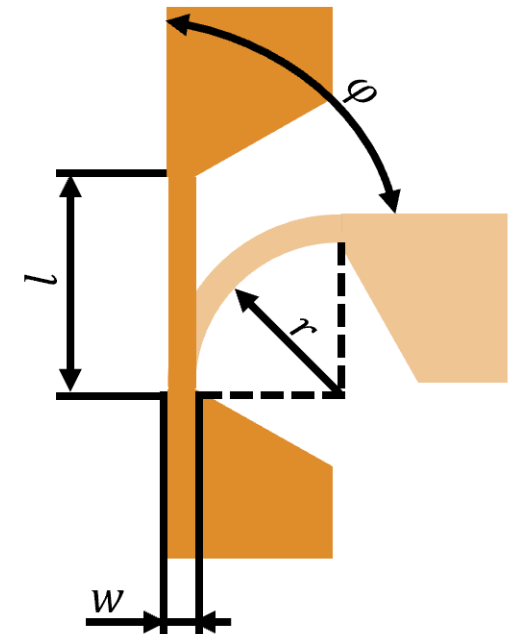
The gap size for joints that are manufactured in the X-, Y- or Z- direction should be 0.4 mm



Integral Hinges

- Possible for the materials PA 2200, PA 2201, and PA 1101
- Integral hinges should be designed open and attached to thick walls if possible
- The following guide values can be used for the design of integral hinges with a radius r of 0.5 mm:

| Opening angle | Length | Wall thickness |
|---------------|---------|-----------------|
| 180° | 1.60 mm | 0.30 to 0.45 mm |
| 90° | 0.72 mm | 0.30 to 0.45 mm |



Font Size

- The minimum font size that can be manufactured (negative and positive) in all directions (X, Y and Z) is approximately 10
- A font size of 10 corresponds approximately to a font height of 3.5 mm
- The inscription should be recessed or raised at least 1 mm
- If possible, use fonts without serifs, such as Arial or Calibri



Tolerances

- SLS manufactured components can only fulfill tolerances with symmetrical deviations (for example, 20 ± 0.2 mm)
- Tolerances depend on geometry and material
- Guide values for the expected tolerances are:

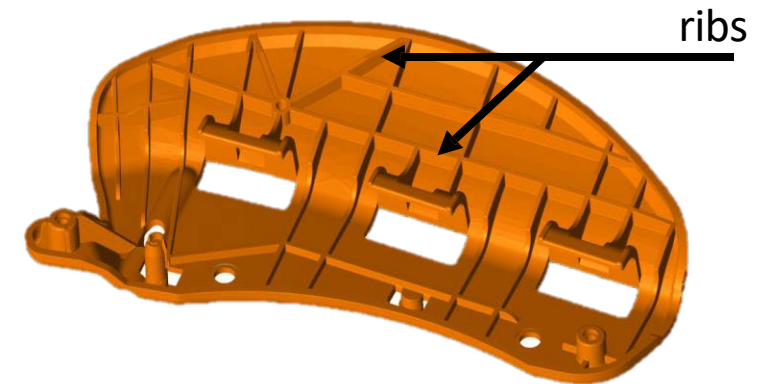
| Nominal dimension | Upper or lower deviation |
|-------------------|--------------------------------------|
| 0 to 30 mm | ± 0.2 mm |
| 30 to 100 mm | ± 0.3 mm |
| greater 100 mm | ± 0.3 % of the nominal dimension |

Powder Removal

- Residual powder must be removable from the component
- The component must not enclose any powder (no internal chambers)
- Thin and long inner tubes, as well as complex inner structures complicate the removal of residual powder
- All components are media blasted and blown off with compressed air to remove the residual powder

Warpage

- Components with large surfaces in combination with thin wall thicknesses are process-related and at risk of warpage
- Reinforcement of large surfaces, for example with ribs, can significantly minimize warpage-effects



Price-optimized Design

If possible, use geometries that can be nested inside each other to save space in the build container and save manufacturing costs



not price-optimized



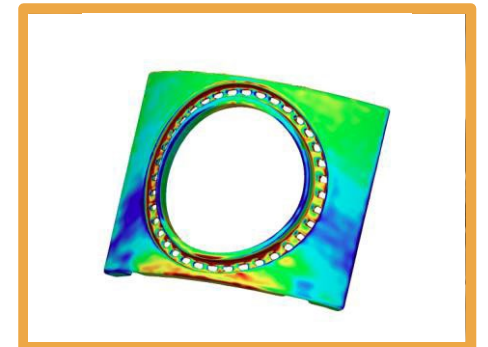
price-optimized

Post-processing





| Procedure | Explanation |
|---|---|
| Media blasting | Blasting of the component surface with glass beads to completely remove the residual powder from the surface and to slightly smooth the surface. This finishing process is used on every component. |
| Chemical smoothing | Chemical smoothing raises the surface quality of SLS parts up to injection moulding level. The pores on the surface of chemically smoothed SLS 3D- printed components are completely closed after applying this process, so that these parts are 100 % waterproof, even under pressure. |
| Vibratory finishing or barrel finishing | Mechanical smoothing of the surface of SLS components by a slight removal of material from the surface by using vibrating grindstones. |
| colouring | Colouring of SLS components without changing the geometry or the dimensions of the components. Colouring is possible in all standard colours such as yellow, orange, red, blue, green, brown, grey and black. |
| Water- or gastight infiltration | Infiltration of the slightly porous surface of SLS components with a 1-component high-performance polymer. Components finished in this way are waterproof and gastight and approved for contact with drinking water and foodstuffs. |
| Mecanical finishing | For example, cutting threads, pressing in thread inserts or reaming drill holes. |
| Pad printing | Printing logos or inscriptions on the surface of SLS parts. For this finishing process, the surface of the component should be chemically smoothed before. |
| Painting | Painting the surface of laser sintered components. |

Quality Assurance

- Creation of initial sample inspection reports, measurement protocols, or false color target/actual comparisons for your 3D-printed parts
- False color target/actual comparisons are created with a GOM ATOS Capsule 3D scanner, by placing the additively manufactured component over the digital twin and indicating the deviations in color



Quotations

- The quotation is free of charge and without obligation
- To prepare a quotation, we need the following data and information mailed to info@priomold.de:
 - CAD data (ideally as .stl, .stp or .step) 
 - Number of pieces 
 - Desired material 
 - Desired post-processing or quality assurance 

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