DESIGN GUIDE

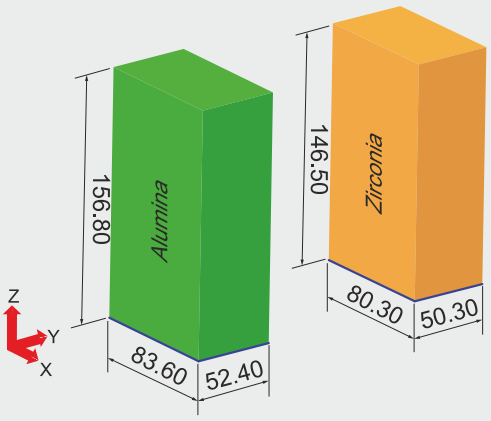
Steinbach AG

MAXIMUM DIMENSIONS/BOUNDING BOX

- Material-dependent (x/y/z):

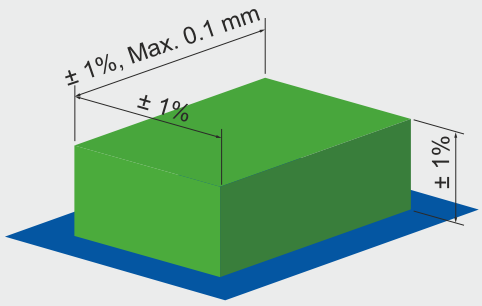
  alumina (FormAlox 999, FormAlox 998):
  83.6 x 52.4 x 156.8 mm
  zirconium oxide (FormAcon 3Y):
  80.3 x 50.3 x 146.5 mm

- These dimensions reflect the limitations of the building platform and include the room for shrinkage.



PRECISION

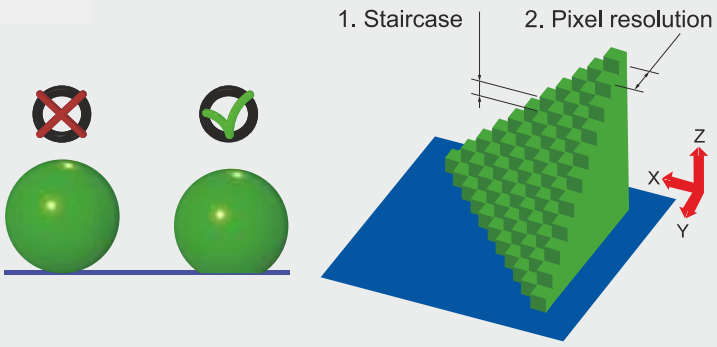
- These tolerances apply: ± 1 % of the length with a maximum of ± 0.1 mm.
- Higher levels of precision can be achieved by iterative approximation.



PRODUCTION-READY GEOMETRY

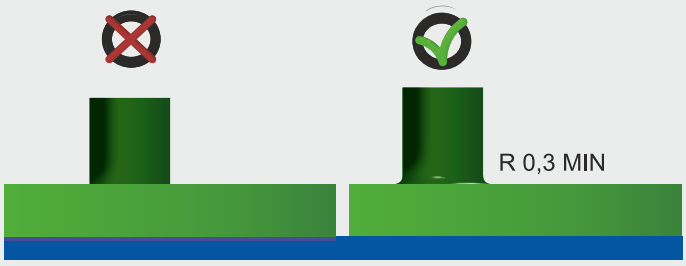
- A flat output surface is required for adhesion to the construction platform
- Printing time depends on the height of the product (Z-orientation)

1. Staircase effect by layer structure (layer-dependent 25-100 µm)
2. Surface quality depends on orientation (X/Y-orientation); pixel resolution (32x32 µm after shrinkage)



CROSS-SECTION VARIATION

- Avoid cross-section connectors since the shrinkage significantly increases the likelihood of crack formation during subsequent thermal processes
- This problem can easily be circumvented by adding radiuses: Rmin 0.3 mm



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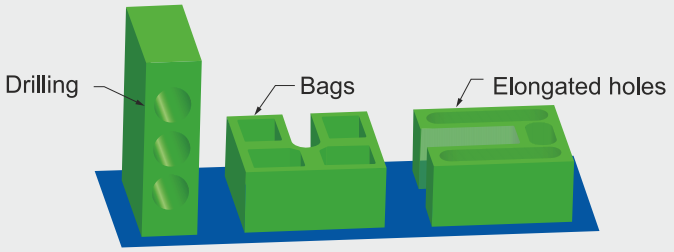
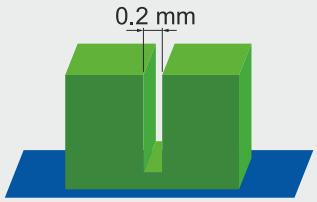
MAXIMUM WALL THICKNESS

- Material-dependent:
  - FormAlox 999: **4 mm**
  - FormAlox 998: **6 mm**
  - FormAcon 3Y: **3 mm**
- Stronger wall thicknesses can result in crack formation during thermal processes
- Wall thickness can be adjusted by design alterations



GAPS AND SMALL DISTANCES

- Minimum distance geometry / material-dependent: about 0.2 mm
- Smaller distances may lead to loss of separation caused by process



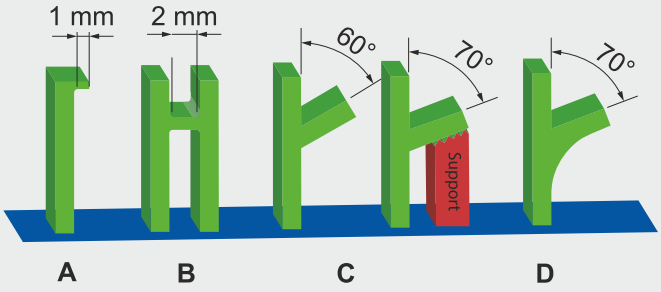
OVERHANGS

A Free overhangs up to approx. 1 mm are possible (material-dependent)

B Free bridging up to approx. 2 mm is possible (material-dependent)

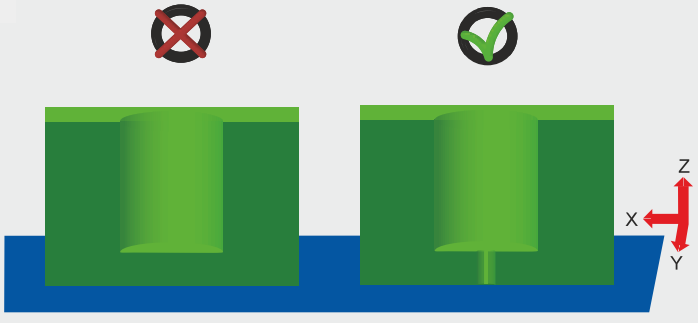
C A support structure is absolutely required for overhangs > 60°
Try to avoid support structures. They will leave slight imprints after removal

D Radii may allow overhangs without supports



DRILLINGS AND CHANNELS

- Minimum diameter is geometry - and material-dependent: **approx. 0.2 mm**
- The process may cause openings to turn out smaller. Recommendation: design drillings and channels slightly bigger than required. We can advise and consult you in this matter.
- Blind holes are producible; through bores are better for the cleaning process
- Recommendation: The best drilling quality will be achieved using Z-orientation



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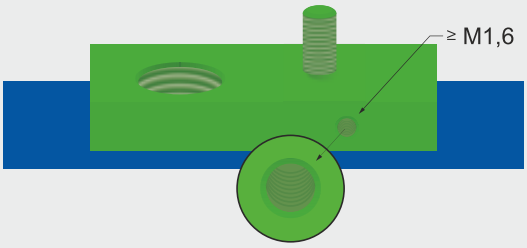
THREADS

- Metric threads ≥ M1.6 producible
- Threads have to be designed as a geometry in CAD, no simplified representation

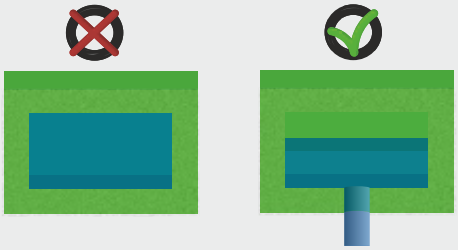
BUT

- Ceramic threads show slackness caused by the material
- Ceramic threads will not be as mechanically robust as metallic threads



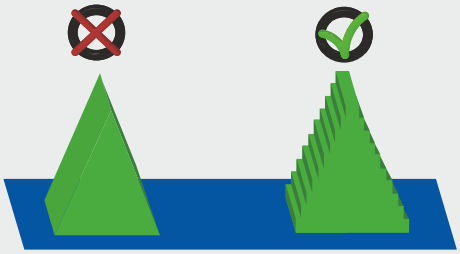
CAVITIES

- Avoid enclosed cavities since cleaning is impossible
- Recommendation: Small openings will allow for cleaning



SHARP EDGES

- Sharp edges converging to zero are not producible
- Process-dependent minimum: 32 µm



MECHANICAL LOAD

- Avoid tensile loads and bending loads