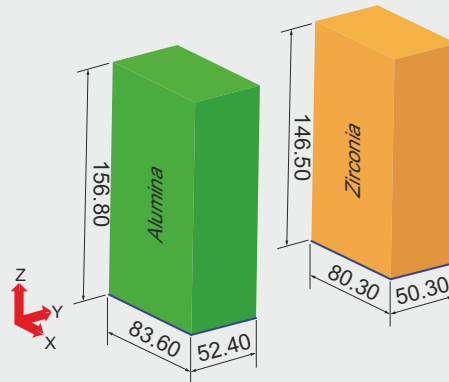


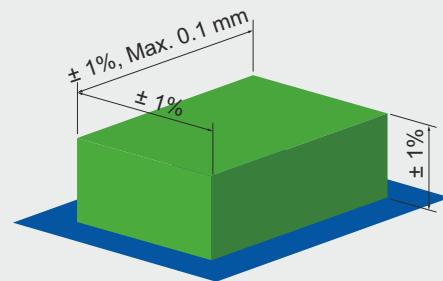
## Maximum dimensions/bounding box

- Material-dependent (x/y/z):  
 alumina (FormAlox 999, FormAlox 998):  
**83.6 x 52.4 x 156.8 mm**  
  
 zirconia (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 (linear shrinkage of approx. 30%)



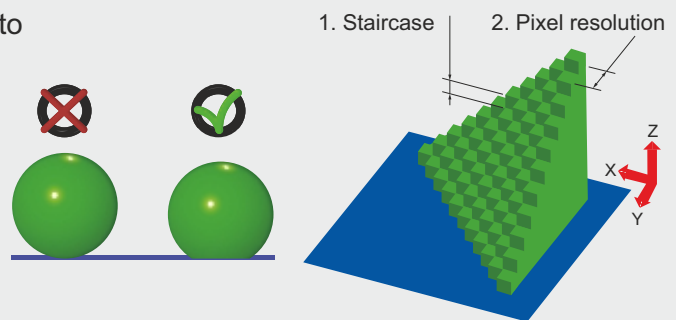
## Precision

- These tolerances apply:  $\pm 1\%$  of the length with a maximum of  $\pm 0.1\text{ mm}$
- 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)
- Staircase effect by layer structure (layer-dependent 25-100  $\mu\text{m}$ )
  - Surface quality depends on orientation (X/Y-orientation); pixel resolution (32x32  $\mu\text{m}$  after shrinkage)



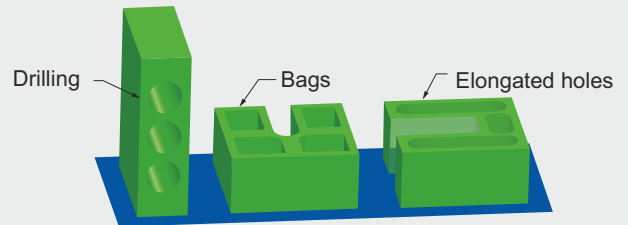
## Cross-section variation

- 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**



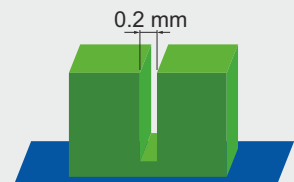
### Maximum wall thickness

- 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



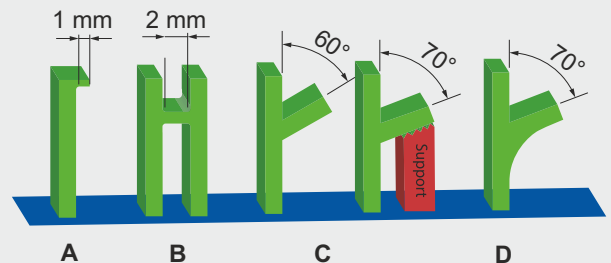
### Gaps and small distances

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



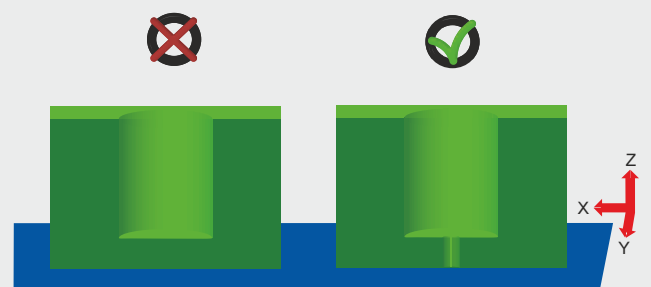
### Overhangs

- 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** 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

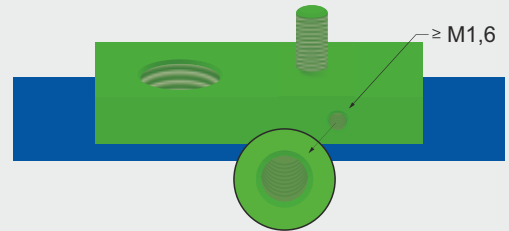


### Threads

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

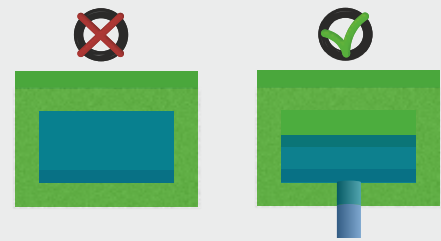
#### But:

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



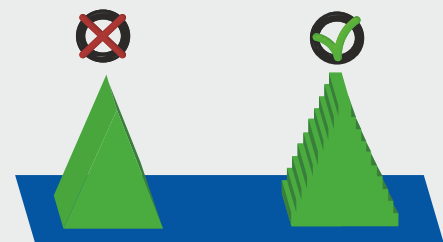
### Cavities:

- 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  $\mu$ m



### Mechanical load

- Avoid tensile loads and bending loads

