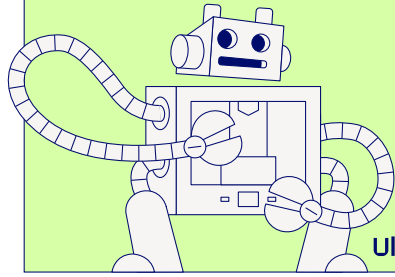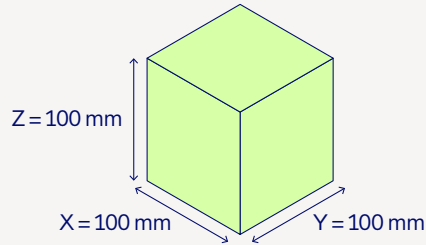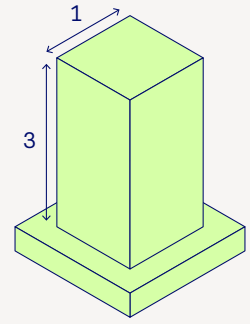# 11 DESIGN GUIDELINES FOR METAL FFF
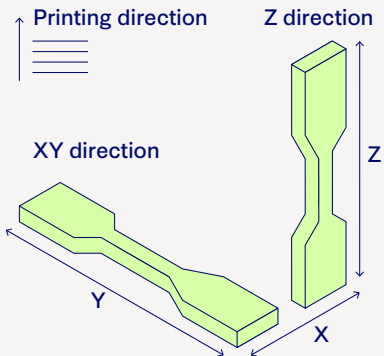
Ultimaker

**Maximum part size:**
Parts should be no larger than 100 x 100 x 100 mm3

Z = 100 mm
X = 100 mm
Y = 100 mm

**Height to width ratio:**
A height to width ratio no larger than 3:1 prevents collapse and distortion

1
3

**Part orientation:**
Parts shrink most in the Z direction. Orient parts in the same direction for printing and D&S to prevent distortion or failure.

Printing direction
Z direction
XY direction
Z
Y
X
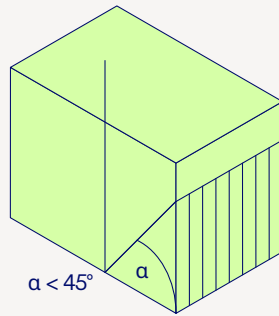
**Overhang angle:**
Angles less than 45° from the build plattform require support

α < 45°
α
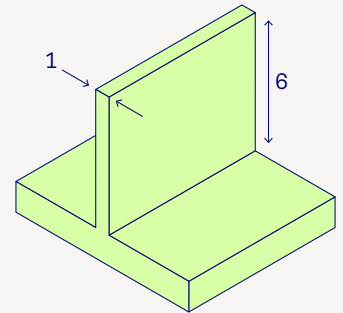
**Unsupported walls:**
For unsupported walls, a height to width ratio of 6:1 prevents collapse

1
6
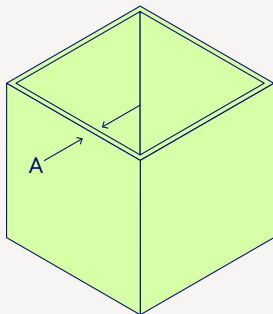
**Thin features:**
Thin features should be a multiple of the nozzle diameter. Where A in the diagram equals nozzle diameter, N should equal a whole number

A

**Shrinkage:**
Typical scaling values can be used to scale up green parts. For more complex parts, the exact values depend on the geometry. Ultimaker Cura 5.1 automatically applies shrinkage compensation to parts.

| Printing axis | Shrinkage (%) | Scaling (%) |
|---------------|---------------|-------------|
| X | 16±0.5 | 119% |
| Y | 16±0.5 | 119% |
| Z | 20±0.3 | 125% |
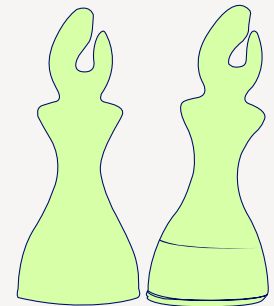
**Flat bottom:**
Parts that do not have a flat bottom are prone to tilting, warping, and cracking as a result of gravity. Gently sand the bottom of the part if it is not flat
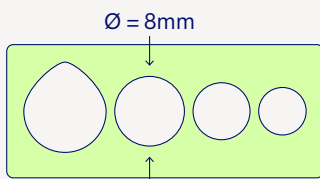
**Horizontal hole diameter:**
Horizontal holes less than 8 mm in diameter can be created with support. Larger holes can be modified to a raindrop shape to prevent collapse

Ø = 8mm
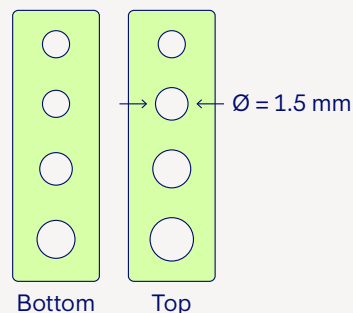
**Vertical hole diameter:**
Vertical hole diameters greater than 1.5 mm are most likely to print successfully

Ø = 1.5 mm
Bottom
Top
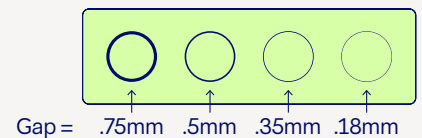
**Gap between parts:**
To prevent cosintering, separate parts should have a gap of 0.75 mm or more

Gap = .75mm .5mm .35mm .18mm