Additive Manufacturing (AM)

Basic Design Rules for Additive Manufacturing
Click on the Pictures to Access Further Information on the Web

Overview of Machines

Overview of Materials

Plastic Material Properties

Design Rules for Metal

Source: EOS GmbH
Additive Manufacturing Design Rules for Plastic
Coordinates

Machine EOSINT P 760

Process chamber EOS P 396

β Z ‡ direction of platform

β X ‡ direction of recoater

Source: EOS GmbH
Building Chamber

FORMIGA P 110

β 200 x 250 x 330 mm

EOS P 396

β 340 x 340 x 620 mm

EOSINT P 760

β 700 x 380 x 580 mm

Attention: Building chamber = Part + Scaling!

β The possible part size is depending on the scaling factor
β Scaling of 3.2 means a possible part size of 329 mm in X direction
β It is not possible to build a 340 x 340 x 600 mm part for EOS P 396
Steps

To avoid steps on your surface, the angle of the plane should be 0° or >20° to the X-Y area. Visibility and size depending on layer thickness.
Hinges

Gaps (A) for Hinges:
- x/y: 0.3 mm - 0.5 mm
- z: 0.5 mm - 0.6 mm

Variables:
- gap between bush and bolt (A)
- length of the hinge (B)
- diameter of the bolt (C)
- thickness of the surrounding bushing (D)
- building direction

With advance geometries smaller gaps are possible
Fonts

- Minimum font size 14 suitable for every direction

- Smaller fonts possible but it depends on:
  - building direction
  - inside / depth of font
  - outside / height of font

- Sans serif font is recommended
Tolerances in Parts

- Depending on the fact that we build exact the same part as in the cad-system designed it is necessary to change your measurements to a symmetric tolerance zone.

- The bad example has an unsymmetrical tolerance zone, the good one a symmetric.

- In the AM process it is only possible to build with symmetric tolerances.
Lose Connection

- Use 0.1 mm distance for lose connection
- A male and female part without a gap have a press fit
- Only for parts not built together! else see hinges
Minimal Wall and Pin Sizes

Walls

X/Y
- min possible wall thickness = 0.7 mm for EOS P 396 / EOSINT P 760
- min possible wall thickness = 0.45 mm for FORMIGA P 110
- min wall thickness for reproducible measurements and mechanical properties = 1.5 mm

Z
- min possible wall thickness = one Layer; typical 0.15 for EOS P396 and 0.10 for FORMIGA P 110

Pins

- min pin thickness = 0.8 mm
- min pin thickness for reproducible measurement and mechanical properties = 1.8 mm
Gaps

The min size of a gap depends on the wall thickness of the part

Gap width [mm]:

- 0.5
- 0.6
- 0.7
- 0.8

Wall thickness:

- 0.30 mm
- 3.00 mm
- 6.00 mm
Holes

Possible min hole diameter depends on the thickness of the wall

Hole diameter:

- 0.5 mm
- 0.6 mm
- 0.7 mm
- 0.8 mm

Wall thickness:

- 0.30 mm
- 0.60 mm
Costs

- Costs depending on Z-height (machine hours) and part volume (powder)

- Reduce Z-height
  - design parts as low as possible in Z
  - stackable for increased filling rate

- Reduce part volume
  - integrated design
  - lightweight design
  - force flow optimized design
Powder Removable Design

- Powder must be removable
  - Problems in small long pipes
  - Very complex parts with inside structure
  - The example is easy to produce but in the long hollow pipe inside it is impossible to remove the whole powder (pic2 grey). With compressed air is it possible to clean one or two windings but the rest remains inside.

- If the powder is removable very simple your post processing time is shorter
Data Format

- The interchange format for RP technologies is **STL**
- The file describe a surface by triangles
- The file size and detail resolution is depending on the number of triangles
- Square-cut surfaces are easy to describe exact pic1. For freeform or round shaped parts you need a lot of triangles pic 2+3
- A guide value for plastic parts is:
  - deviation tolerance: 0.01 mm
  - angle tolerance: 2°
For further question please contact info@eos.info