Part design for Multi Jet Fusion

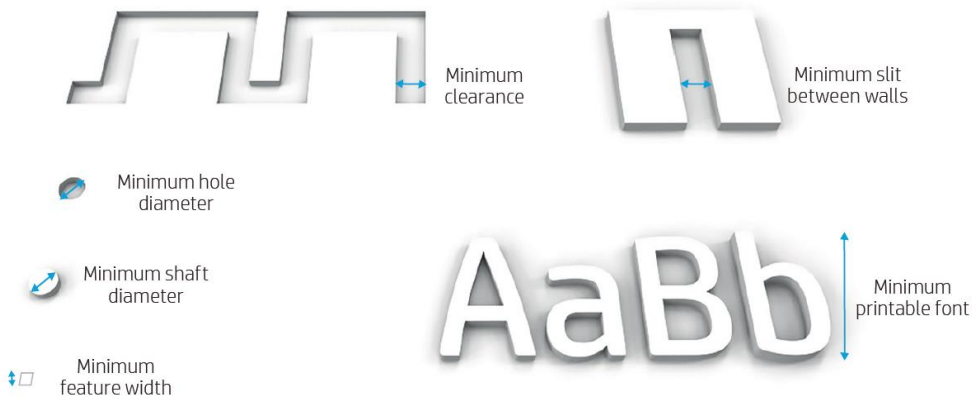
Dimensional accuracy

Minimum printable features

To achieve maximum accuracy when designing with HP Multi Jet Fusion (MJF) technology, there are certain specifications to bear in mind.

The **minimum printable features in planes X, Y, and Z** are as follows:

Minimum hole diameter at a thickness of 1 mm	0.5 mm
Minimum shaft diameter at a height of 10 mm	0.5 mm
Minimum printable font size	6 pt
Minimum printable features or details (width)	0.1 mm
Minimum clearance at thickness of 1 mm	0.5 mm
Minimum slit between walls/embossed details	0.5 mm

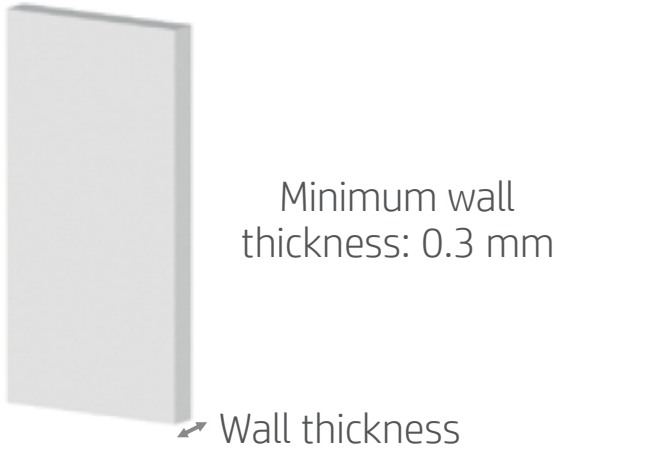


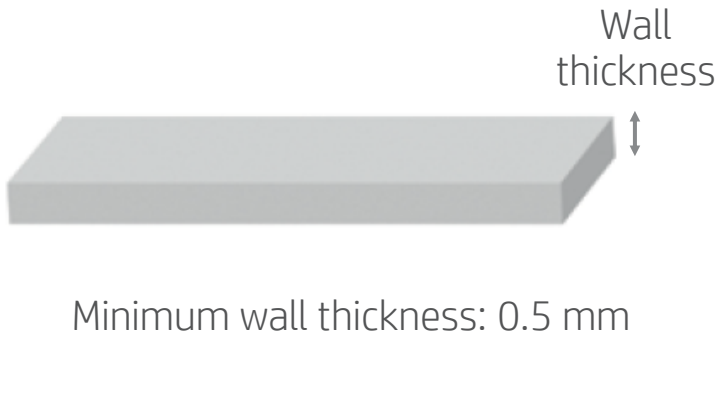
IMPORTANT: During print preparation it is **not necessary to add a contraction coefficient**. This is compensated for automatically by the printer.

Wall thickness

The **minimum wall thickness** depends on the orientation of the part.

Short walls orientated on the XY-plane	0.3 mm
Short walls orientated on the Z-plane	0.5 mm





However, it is recommended to **increase thickness** beyond this value or add ribs or fillets in order to reinforce the parts.

NOTE: Smaller thicknesses can be printed but can easily be damaged. An MJF part printed at 45° with a minimum thickness of 0.1 mm:

TIP: Make your part as hollow as possible. It saves agent and material. Also, sink marks are reduced.

Engraving

Multi Jet Fusion technology allows for printing letters, and a number of drawings with **very high resolution and definition**

> ! **IMPORTANT:** Any text, number or drawing included in a part is recommended to have **at least 1 mm of depth** and to be **oriented in the XY plane**

For parts with **high thickness**, the depth or protrusion should be **higher than 1 mm**

- Embossings: better oriented upside down
- Debossings: better oriented face up

Emboss 1mm

Deboss 1mm

Solid part or structurally filled?

Advantages of using structural fill

Structural fill designs helps to **reduce**:

Weight of the part

Lighter parts generally increase the **accuracy** of the system and improve look and feel (reduced sinks and termal bleeds)

Quantity of material used

Lower agent **consumption**

Operating costs in very weight-sensitive applications

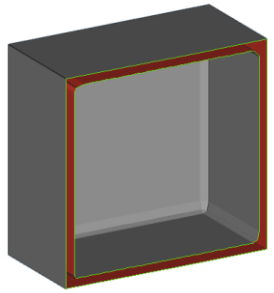
Complex designs can **improve function** at no extra cost

Solid part or structurally filled?

Re-design strategies

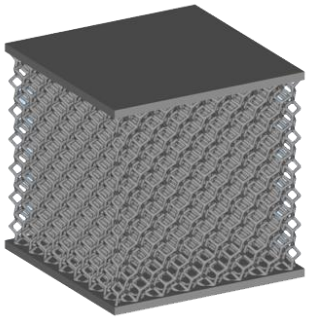
Multi Jet Fusion allows you to print:

Hollowed parts



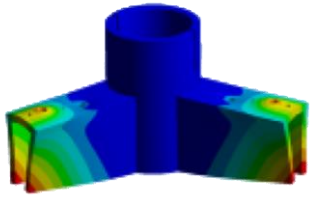
- Suited for **dense parts** that do not have high mechanical requirements
- An automatic re-design that can be applied in minutes
- Cost and weight of part are highly reduced

Lattices



- **Middle ground between hollowed and solid parts**
- Useful in applications that require fluid flow through the part
- An automatic re-design that can also be applied in minutes once the type of lattice is chosen

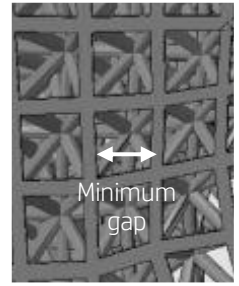
Optimized topology



- Suited for parts that have **complex load distributions**
- Optimized weight reductions are achieved while retaining mechanical properties
- The re-design time investment is higher and requires more engineering hours

TIP: Make your part as **hollow** as possible. For PA12, this saves agent and material, and also sink marks are reduced.

NOTE: For PA12 the minimum gap recommended in a **lattice structure** to ensure that all the material inside the part can be removed is **1 mm**.



Hollowed parts

Open vs. closed hollow parts

Multi Jet Fusion is a process where parts are built by **selectively fusing** the desired areas of material-based layers. There are **two main options** for hollowing a part:

Open

- In order to remove the material, **drain holes** need to be added to the design.
- The minimum recommended diameter of the **drain holes is 5 mm**.
- The recommendation is to include **at least 2 holes**.
- **Maximum weight reduction but high mechanical trade-off**

Two escape holes

Recommended

One escape hole

No escape hole

Closed

- There is still a **noticeable weight reduction** due to the density difference between fused and unfused material
- **Internal lattices can be added** for additional mechanical performance at a low cost
- Loose material inside the part could be released if outer shell is broken

Hollowed parts

Open vs. closed hollow parts

Egg sample

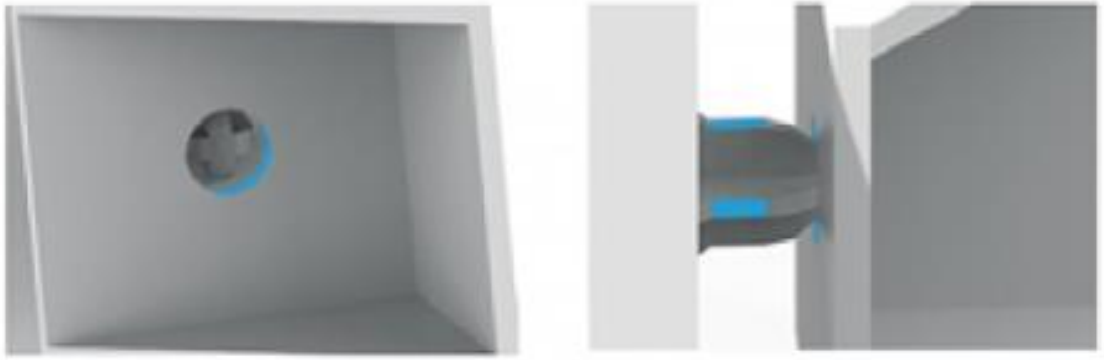
Solid Egg

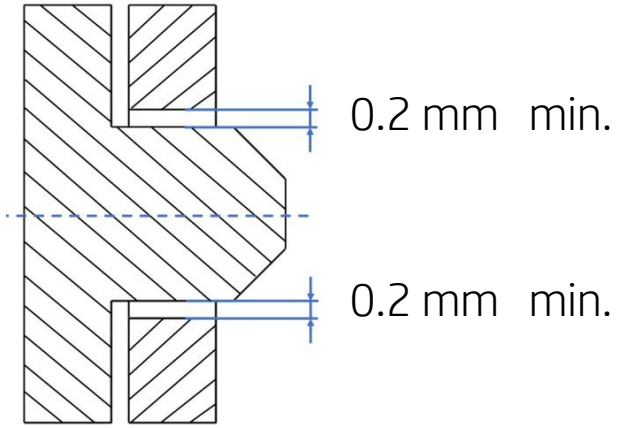
Close Hollow Egg (2mm shell)

Connecting parts

Parts assembled after printing

- A pair of printed parts need to fit together – e.g., **pin** and **hole** – to create the final product
- The minimum **clearance** between the interface areas should be **at least 0.4 mm diametral**



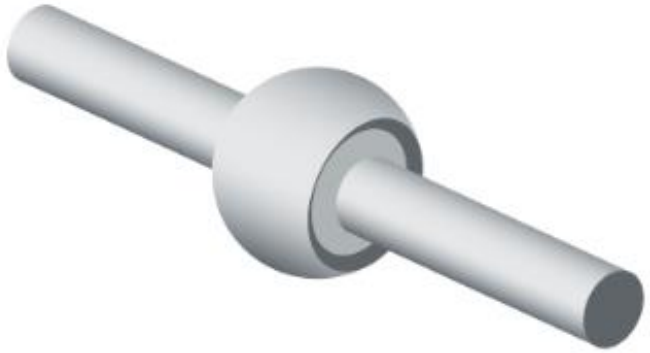


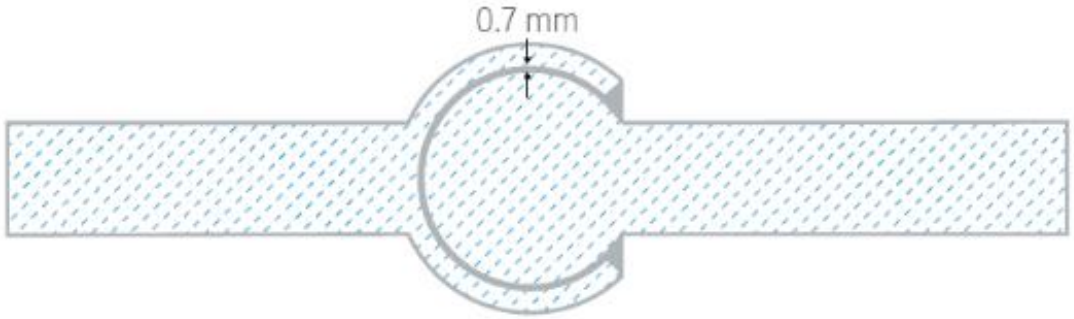
TIP: Test your specific case with **Test fitting**

Moving parts

Parts printed together as functional assemblies

- **Clearance** between faces of parts printed together should be a minimum of **0.7 mm**
- Parts with a wall thickness **smaller than 3 mm**, can have a **clearance as low as 0.3 mm**
- Parts with a wall thickness **greater than 30 mm** should have a **clearance > 0.7 mm**





TIP: Test your specific case with **Test fitting**

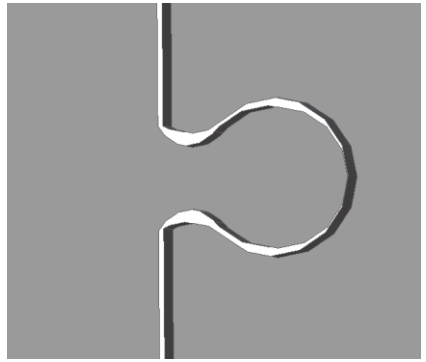
Ducts

- To remove the material from inside ducts, a **chain** through the duct can be designed and printed.
- When the parts are printed, the chain can then be removed by **pulling it out**, and this will allow the sand blaster beads to enter the duct and **remove the remaining material.**

Include strips or chains inside the 3D model to print it

Assembly of big parts

- Parts bigger than the largest supported build size can be printed with Multi Jet Fusion by splitting them up into different parts.
- Options available to ensure proper jointing between them:
  - Glue the parts
  - Weld the parts
  - Piece the parts together with pin inserts or other mechanical attachments (screws, nuts, etc.)
- Recommended geometries for gluing parts:



- To obtain good outcome, part designs should have 0.1-0.2 mm of clearance in addition to the minimum spacing (0.5 mm) recommended between parts in order for glued parts to maintain their dimensional properties.

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