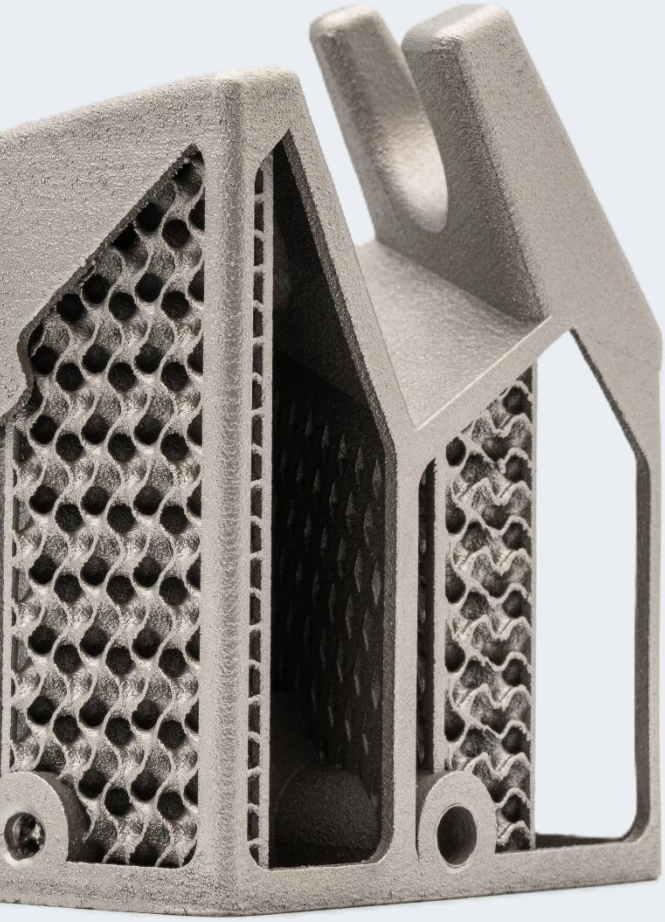
DESIGN GUIDELINES for BEGINNERS in metal AM

In PBF-LB/M, geometry must be self-supporting
— otherwise, you will pay for it with supports, costs, and risk!

SUPPORTS – why they are required?



In PBF-LB/M, parts are built layer by layer by selectively melting metal powder with a laser. Each newly formed layer must be properly supported due to residual stresses generated during the process, which can lead to distortions, warping, or even cracking.

Loose metal powder does not provide adequate mechanical support for melted material. As a result, overhanging features cannot be reliably built without proper layer support.

The most effective strategy to avoid additional supports is to design parts that are inherently self-supporting. This requires considering the build orientation at the earliest stage of the design process. This document provides a set of practical guidelines for designers who are new to metal additive manufacturing, helping them create geometries optimized for PBF-LB/M processes.

Lack of sufficient support typically results in:

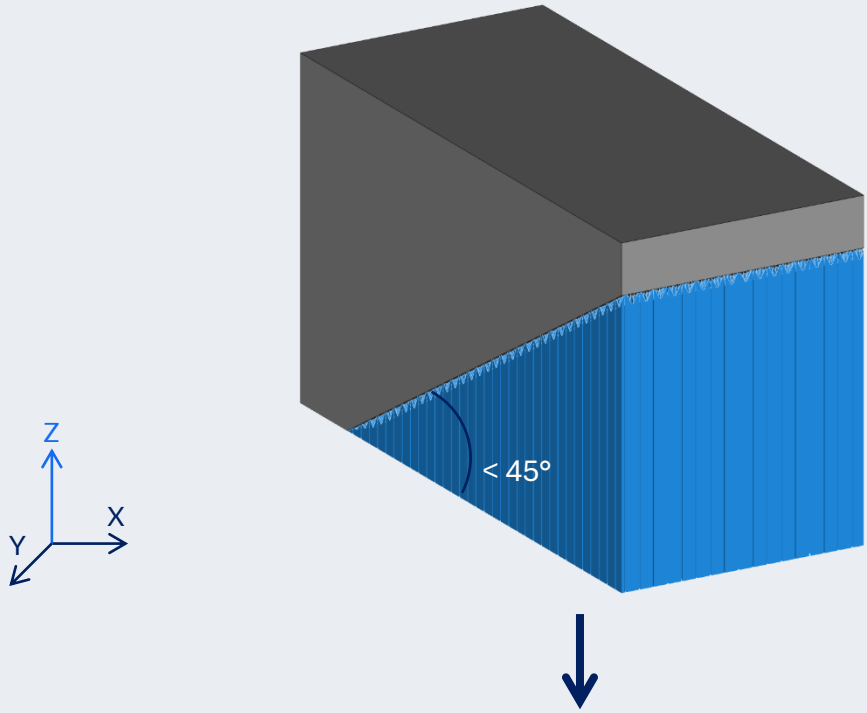
- **geometric deformations**
- **poor surface quality**
- **local defects**
- **complete build failure** (in extreme cases)

The build direction is defined along the Z-axis.

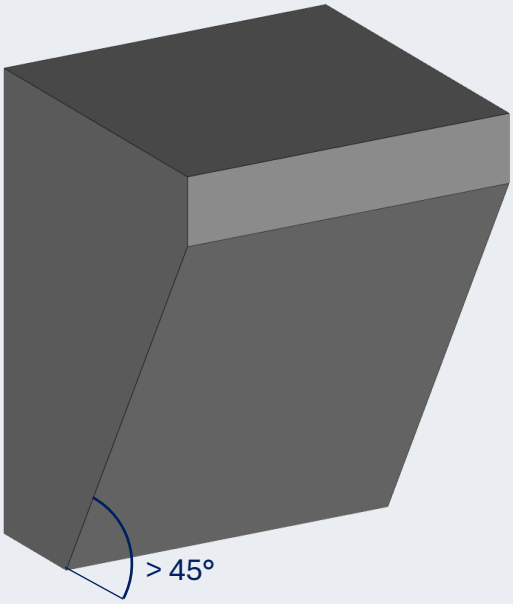
➢ INCLINATION ANGLE

Surfaces with an inclination angle below 45° relative to the build plate require support structures.

SUPPORT REQUIRED



SELF-SUPPORTING

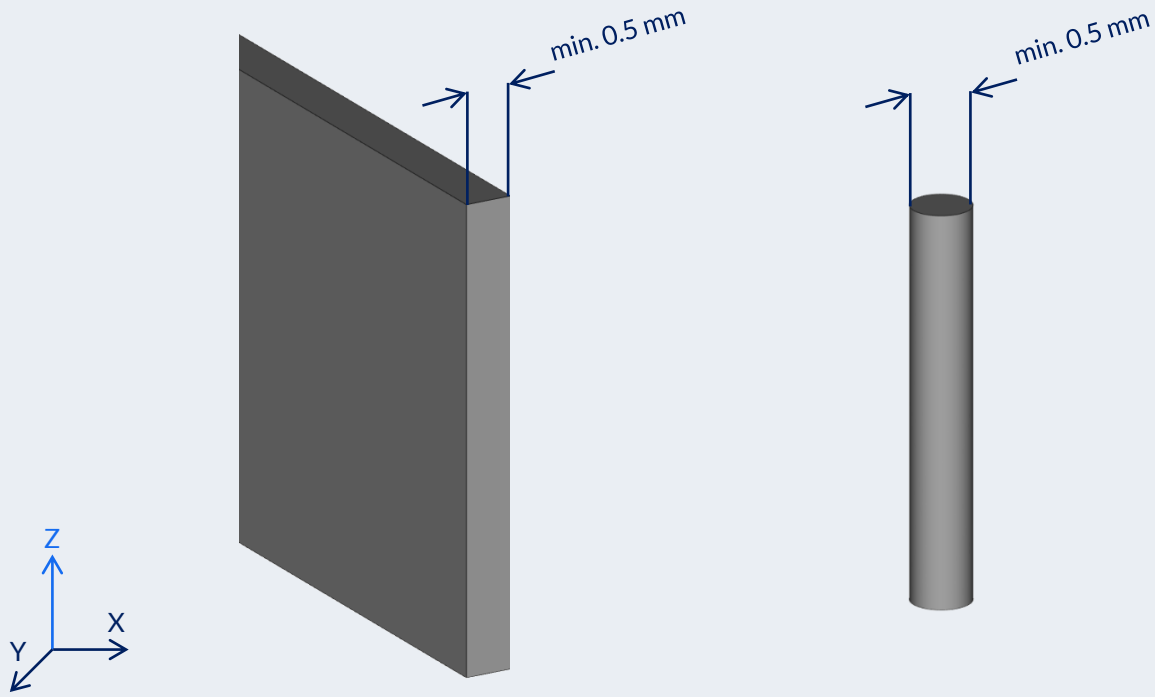


➢ WALL THICKNESS & PIN DIAMETER

Recommended minimum wall thickness: **0.5 mm.**

Recommended minimum pin diameter: **0.5 mm.**

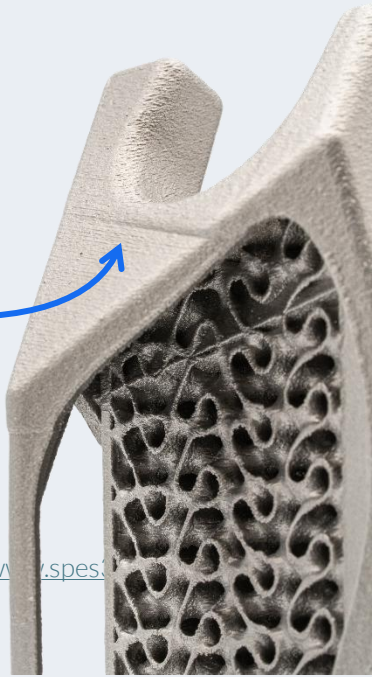
Walls and pins down to **0.3 mm** are possible when built in Z direction, but they are highly fragile and prone to damage during post-processing.



THICKNESS TRANSITIONS

Rapid changes in wall thickness can introduce residual stresses, often visible as distortions or surface lines.

Similar effects may also occur when separate walls or features, which were previously built independently, merge into a single geometry during the build.

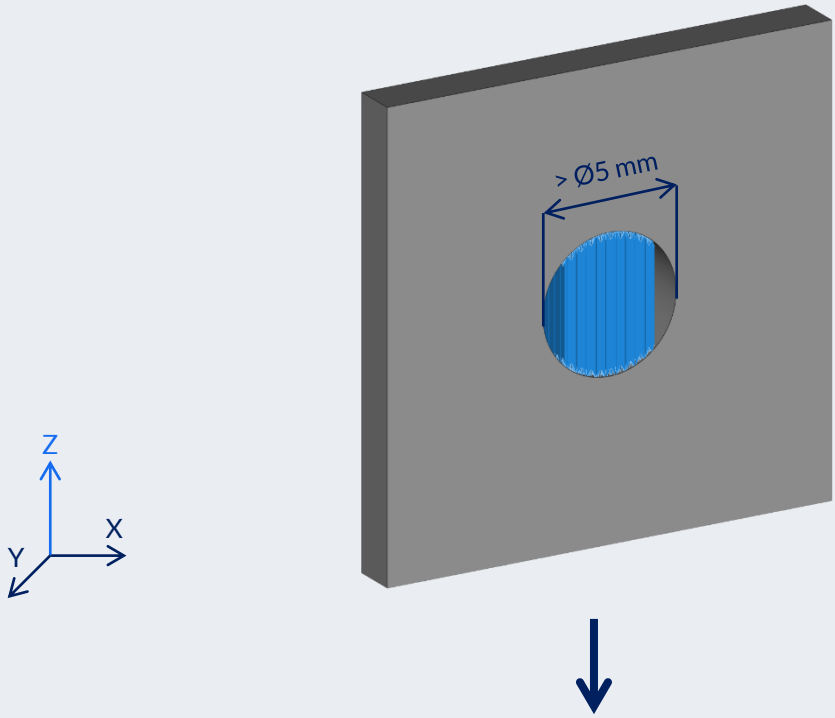


➢ HOLES / CHANNELS DIAMETER & SHAPE

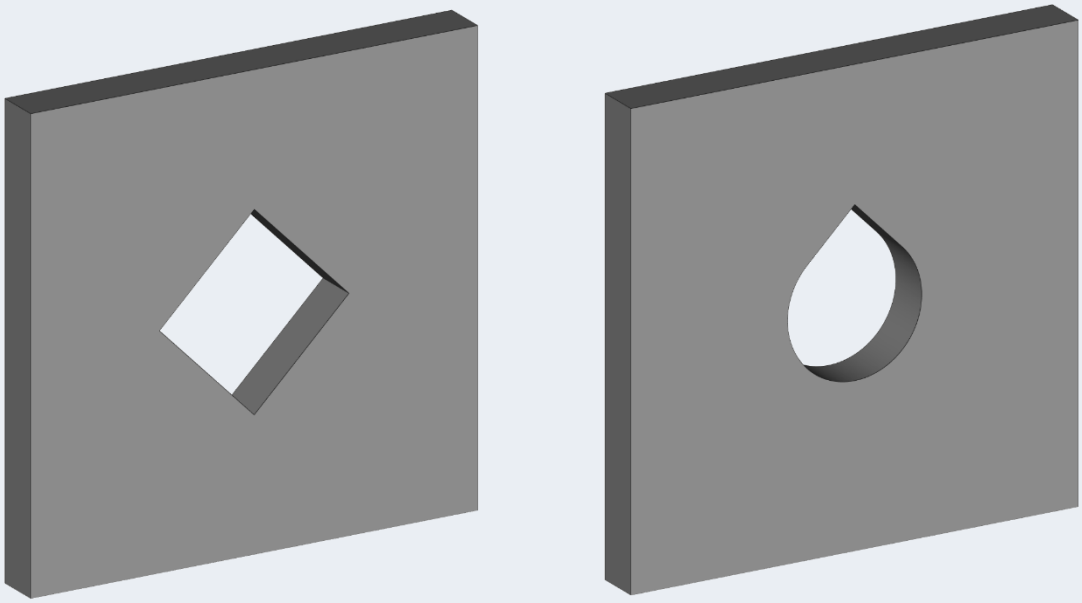
Self-supporting hole diameter range: **0.5 – 5.0 mm**. Holes above this range typically require supports.

To avoid supports, consider redesigning the cross-section into a diamond or teardrop shape. Ensure that surfaces maintain a minimum inclination **angle of 45°** relative to the build plate.

SUPPORT REQUIRED



SELF-SUPPORTING

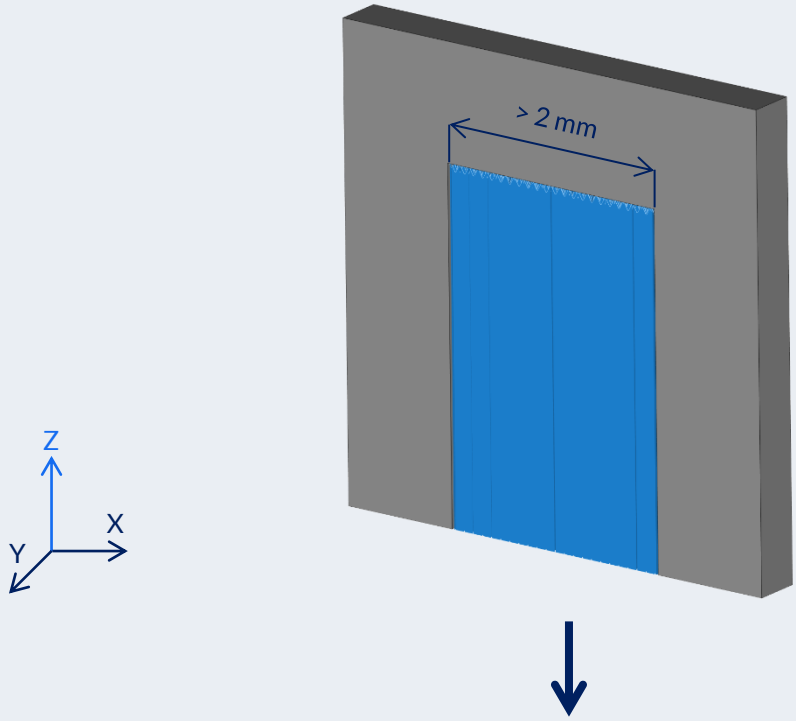


➢ BRIDGES

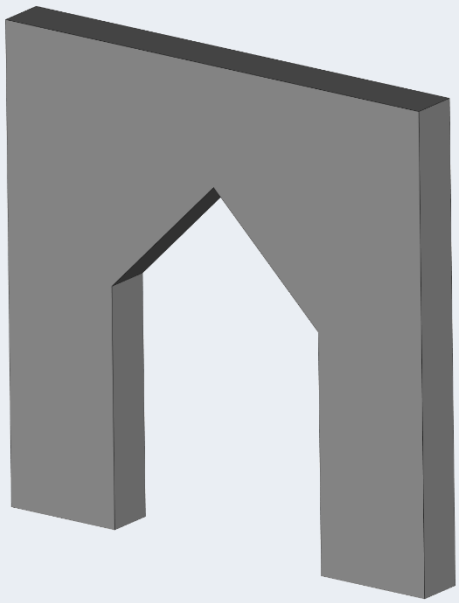
A bridge is a horizontal feature connecting two vertical elements.

Recommended maximum bridge length: **2 mm.** Longer bridges require supports and may also lead to visible surface defects, such as shrinkage lines caused by residual stresses during the build process.

SUPPORT REQUIRED



SELF-SUPPORTING

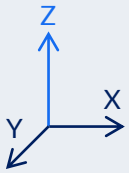


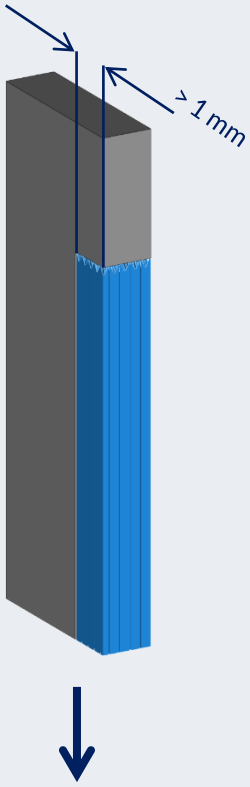
➢ OVERHANGS

Recommended maximum overhang length: **1 mm.** Larger overhangs require supports

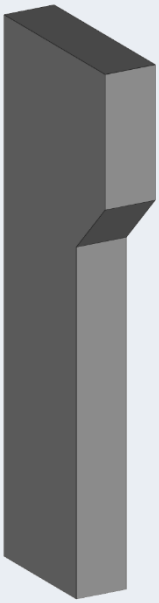
Support requirements can often be avoided by introducing a **45° chamfer** instead of a flat overhang.

SUPPORT REQUIRED





SELF-SUPPORTING



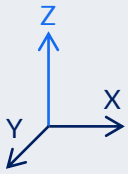
➢ HOLLOW

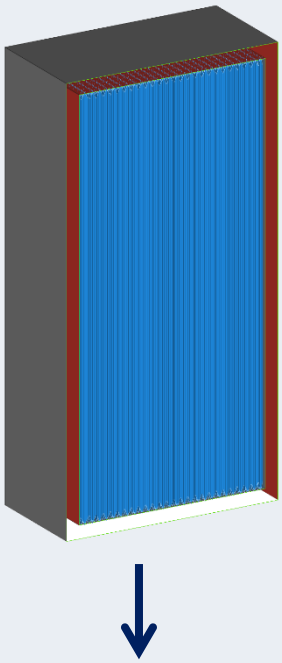
Hollowing parts is an effective strategy to reduce mass and material usage. However, it must be implemented with proper powder evacuation in mind.

Internal cavities must include **sufficient escape holes** to allow unmelted powder to be removed after the build. Without proper openings, powder will remain trapped inside the part.

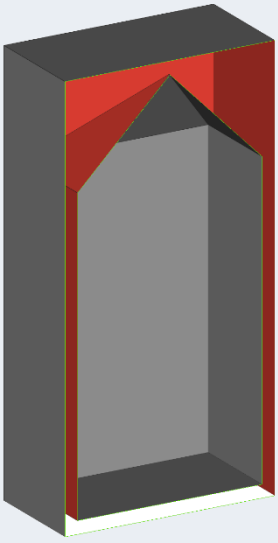
Warning:
Internal geometry should be evaluated with the same rules as external features. **If supports are generated internally and cannot be accessed, they cannot be removed!**

SUPPORT REQUIRED





SELF-SUPPORTING



➢ THREADS

Direct printing of threads is generally **not recommended** due to risk of deformation caused by residual stresses, and surface roughness typical for the PBF-LB/M process.

For this reason, threads are typically created during **post-processing** conventional machining methods.

For this reason, it is recommended to design holes with the appropriate diameter, while the final thread is created after printing.

GENERAL DESIGN REMINDERS

Consider the build orientation at the earliest stage.

Minimize the need for supports to reduce cost and improve quality.

Check internal features – they follow the same rules.

Ensure accessibility for powder and support removal.

Still have questions?

These guidelines cover the most common design rules for PBF-LB/M, but every project comes with its own technical requirements and challenges.

If you did not find the information you were looking for or are unsure whether your design is suitable for metal additive manufacturing, feel free to contact us. Our team will be happy to review your design, answer technical questions, and help you optimize your part for the PBF-LB/M process.

If your technical documentation includes additional requirements related to dimensional tolerances, surface quality, heat treatment, machining, or other post-processing operations needed to meet specific standards, we can support the entire workflow in-house. Our machine park enables us to perform post-processing directly after printing, ensuring efficient production and better process control.

Contact us and let's find the best manufacturing solution for your part.

+48 882 191 184 // kontakt@spes3d.pl

IMPORTANT:

These guidelines are general recommendations. Optimal values may very depending on material, machine, and part geometry.

Spes 3D
Print your own way

V1.0 | 05.2026