



**DYEMANSION**  
**POWERFUSE S & POWERFUSE S PP**  
**DESIGN GUIDELINES**





# DYEMANSION POWERFUSE S & POWERFUSE S PP DESIGN GUIDELINES

## INTRO

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To get the best VaporFuse Surfacing result for your part, several things must be considered during the design phase. Geometric features, mounting, printing, and part handling have an impact on the smoothing result. This document lists the most important design suggestions and is considered a supplement to the Process Guidelines for the Powerfuse S & Powerfuse S PP.

## FACTORS INFLUENCING VAPORFUSE SURFACING

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Consideration of the entire AM value chain

[Design - Geometric Features](#)

[Design - Mounting](#)

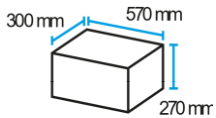
[Influence of printing process](#)

[Pretreatment of the part](#)

## DESIGN GUIDELINES

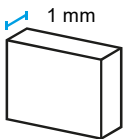
# DESIGN - GEOMETRIC FEATURES

During the process, defects such as warpage and blistering may occur within the part. By following the design suggestions below, these can largely be avoided.



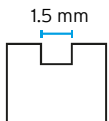
### MAXIMUM SIZE

The size of the part must not exceed 300 mm x 570 mm x 270 mm (L x W x H).



### MINIMUM WALL THICKNESS AND TRANSITIONS

To avoid warpage of the part, a minimum wall thickness of 1 mm for PA- and PP-materials and 1.5 mm for TPE-materials is recommended. In DyeMansion standard programs, a maximum wall thickness of up to 15 mm is recommended, while in Universal programs, a thickness of up to 40 mm is possible. In addition, abrupt changes in wall thickness should be avoided. Similar wall thickness within the part leads to a homogeneous smoothing result.



### MINIMUM GAP SIZE

Vaporfuse VF47 Eco fluid & VaporFuse VF44 Eco Fluid PP can accumulate in narrow gaps or tunnels. As a preventive step, a minimum gap and tunnel size of 1.5 mm should be maintained.



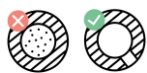
### CORNERS

The angles in the part should be designed  $> 90^\circ$  to avoid accumulation of Vaporfuse VF47 Eco Fluid & VaporFuse VF44 Eco Fluid PP. In general, rounded angles are recommended.



### CHANNELS AND OPENINGS

All surfaces to be smoothed must be accessible to the solvent during the VaporFuse Surfacing. Geometric features with openings on both ends are preferable to features with deep one-sided openings. Diameter and length ratios should be considered for each specific application.



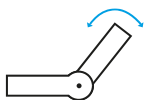
### CAVITIES

Cavities filled with loose powder should be avoided to prevent collapse of the structure. If this is not possible, a minimum wall thickness of 3 mm and additional stabilization is recommended.



### LARGE AND FLAT PLANES

Large and flat plates should be avoided, as stress build-up and warpage are likely to occur. If these are unavoidable in the design, suitable stabilization of the area must be provided.



### MOVING PARTS

Moving parts merge close to the contact points, and should ideally be mounted separately. Depending on the application, spacers or fixings can also be added to avoid contact with moving parts.

## DESIGN GUIDELINES

# DESIGN - MOUNTING

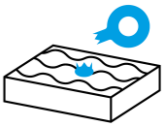
The parts are suspended during VaporFuse Surfacing. Any point of contact with the rack or other parts may leave marks on the part. For convenient handling, it is recommended to attach an eyelet to the part, which can be removed after VaporFuse Surfacing. Proper placement of the eyelet can have a positive effect on the smoothing result. A suitable STL file can be obtained from [DyeMansion upon request](#).



An eyelet with a diameter of at least 7 mm can be used for suspension. To avoid tearing off during the process, there must be a strong connection between the eyelet and the part. In addition, the material diameter of the eyelet must be based on the material and weight of the part. The following table lists recommendations for this:

WEIGHT OF THE PART	DIAMETER EYELET (PA & PP-MATERIAL)	DIAMETER EYELET (TPE-MATERIAL)
Up to 100 g	3 mm	4 mm
Up to 250 g	4 mm	6 mm
Up to 350 g	6 mm	Multiple eyelets
From 350 g	Multiple eyelets	Multiple eyelets

### THE FOLLOWING RECOMMENDATIONS SHOULD BE FOLLOWED FOR THE PLACEMENT OF THE EYELET:



When removing the eyelet after VaporFuse Surfacing, a visible and unsealed area will be left behind. Therefore, the eyelet should be placed in a location that will not be visible later or is unimportant for the application.



The eyelet should be placed to the core part structure to ensure even weight distribution. Due to the lower softening temperature of TPE, the weight should be distributed evenly over TPE parts using support structures.



The eyelet should be placed in a way that upward facing sinks and the accumulation of Vaporfuse VF47 Eco Fluid & VaporFuse VF44 Eco Fluid PP is avoided.



To comply with placement guidelines, it may help to place several eyelets on the part. For easier handling, we recommend spacing the eyelets between 70 mm and 125 mm apart.

Instead of an eyelet, a hole in the part can be used for suspension, considering the above points. Please note that contact with the rack may leave marks on the parts.

## DESIGN GUIDELINES

# INFLUENCE OF PRINTING PROCESS

The printing of the part already has an influence on the smoothing result. Each part must be considered individually and with equal care. Following the print manufacturer's recommendations as well as the suggestions listed here is essential for an optimal VaporFuse Surfacing result.

- ✓ The result of VaporFuse Surfacing is highly dependent on the quality of the base material. For best results, parts should be printed exclusively with quality powder. All recommendations of the printer manufacturer must be followed.
- ✓ To avoid a stair effect in the part, it is advised to print visible areas or areas that are important for the application in the Downskin.
- ✓ Defects in the part created by a faulty printing process cannot be corrected by VaporFuse Surfacing. Instead, they may only become visible after post-processing. The following tables provide an overview of the most common defects, possible causes, and the appearance after VaporFuse Surfacing (no claim to correctness/completeness. Here we refer to the guidelines of the printer manufacturers).

### ELEPHANT SKIN

#### PRINTED PART AFTER CLEANING:



#### Possible causes:

- ✓ Powder bed temperature not controlled properly
- ✓ Minimum part distance (interaction of detailing agent of neighboring parts)
- ✓ Positioning too close to the border of printing bed

#### PART AFTER VAPORFUSE SURFACING:



#### Appearance after VaporFuse Surfacing:

- ✓ Local shrinkage of outer surface
- ✓ Flaking off outer surface
- ✓ Delamination

### DELAMINATION

#### PRINTED PART AFTER CLEANING:



#### Possible causes:

- ✓ No proper binding between layers (sometimes not visible)
- ✓ Laser parameters not well adjusted (e.g. power too low, focus offset)
- ✓ Exposure jumps

#### PART AFTER VAPORFUSE SURFACING:



#### Appearance after VaporFuse Surfacing:

- ✓ Separation of layers at the edge or within the part

## DESIGN GUIDELINES

# INFLUENCE OF PRINTING PROCESS

### WARPAGE

#### PRINTED PART AFTER CLEANING:



#### Possible causes:

- ✓ Internal mechanical stress caused by thermal stress in printing (e.g. part positioned in different heat zones, exposure jumps, hatching (SLS), part orientation, heat influence of adjacent parts) and cooling down (e.g. too fast cooling/unpacking)

#### PART AFTER VAPORFUSE SURFACING:



#### Appearance after VaporFuse Surfacing:

- ✓ Warpage and deformation of the part especially with thin-walled structures

### CONTAMINATION WITH PARTICLES

#### PRINTED PART AFTER CLEANING:



#### Possible causes:

- ✓ Particles from environment attach to parts surface (often hardly visible)
- ✓ Parts not sealed after printing/cleaning
- ✓ Handling/transport of parts
- ✓ No gloves used
- ✓ No clean work environment

#### PART AFTER VAPORFUSE SURFACING:



#### Appearance after VaporFuse Surfacing:

- ✓ Visible stains on part surface
- ✓ Particles fused/dissolved into surface
- ✓ Parts not sealed after VaporFuse Surfacing

## DESIGN GUIDELINES

# PRETREATMENT OF THE PART

After printing the part, further steps must be considered, which can have a significant influence on the smoothing result.

- ✓ For a uniform smoothing result, parts from powder bed-based processes must be completely depowdered. Especially in gaps and edges, residue powder can lead to solvent accumulation and blistering. Furthermore, no residues of the blasting material should remain on the surface. For an optimum depowdering result in combination with the Powerfuse S & Powerfuse S PP we refer to the DyeMansion Powershot C. Recommendations for depowdering with the Powershot C can be taken from the [DYEMANSION ON-DEMAND SERVICE GUIDELINES](#).
- ✓ Avoid cross contamination of different materials before processing. PA particle residues cause defects on a PP surface. It is recommended to depowder all PP with a plastic blasting media like PC4.
- ✓ Long storage of parts should be avoided if possible. For ideal results, parts should be processed immediately after the printing job. In this way, oxidation or the absorption of water can be avoided. Alternatively, the parts can be stored in airtight plastic bags without exposure to light.
- ✓ Parts must only be colored after VaporFuse Surfacing. Additionally, contact with liquids or organic components must be avoided to prevent contamination of the Powerfuse S & Powerfuse S PP.
- ✓ During the entire processing of the parts, the parts should only be handled with gloves.

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