Xtreme 8K E-RigidForm Design Guide

July 2023

ETEC

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Legal Notice

About This Guide

This guide shares geometric capabilities and provides design guidance for E-RigidForm material printed with the Xtreme 8K™ 3D printer.

Important: Testing for this guide was performed with ETEC’s E-RigidForm material on the Xtreme 8K™. Minimum feature size is dependent on material, printer, and geometry. All applications should be validated with the appropriate equipment.

Xtreme 8K™ E-RigidForm Design Guide: X8K-DEG-00042-Rev01-EN July 2023

About the Technology

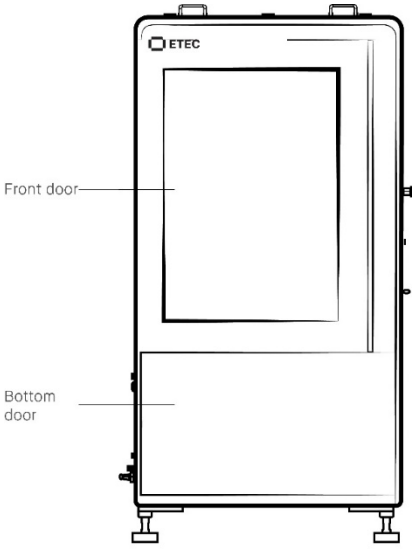
E-RigidForm is a polyurethane-like resin that 3D prints strong, hard, and stiff end-use parts. E-RigidForm has high tensile strength, delivers good heat deflection, and is water-resistant. E-RigidForm is a versatile and tough material that is ideal for for a wide range of industrial and consumer applications.

Part printed in E-RigidForm

The Xtreme 8K™ makes volume production of 3D-printed parts a reality, with the ability to print thousands of parts per day. With wide material compatibility, including hard plastics, high-temperature plastics, elastomers and rubbers, the Xtreme 8K™ enables the production of the broadest possible range of parts.

The Xtreme 8K™ leverages long-chain polymer chemistry to create fully-isotropic, stable, end-use parts, and features a heated vat, allowing users to process highly viscous and solid materials at room temperatures.

Visit etec.desktopmetal.com for more information.

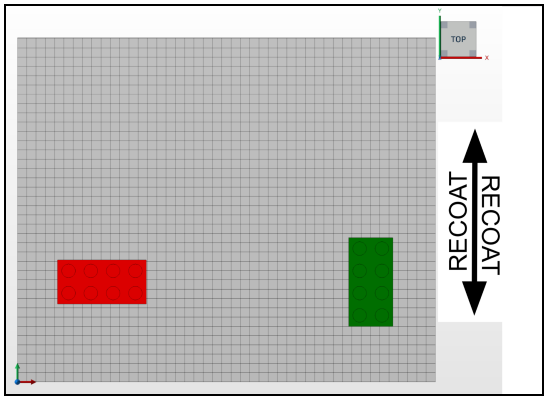


Xtreme 8K Front View

Orientation Considerations

The Xtreme 8K has a blade style recoater which passes over each layer during every print job. This blade travels in the Y direction. For best printing results, orient parts facing the X axis instead of the Y axis.

Important: When orienting parts, minimize the part profile facing the Y direction.

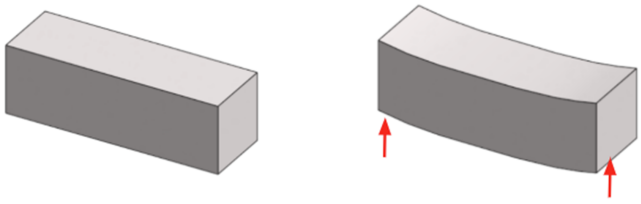


The same part placed in two orientations: the left part faces the Y axis and is not recommended; the right part faces the X axis and is best practice

Note: Testing over a range of features showed acceptable results even in the unfavorable orientation.

Curling

Resin is cured by UV light in the DLP 3D printing process. This transition from liquid to solid results in internal stresses. If the internal stresses are not handled properly, then part warping can occur. This is especially prevalent for large flat areas printed along the XY plane.



Curling is minimal for flat parts 75 x 75 mm and smaller. For parts over 75 mm in length, curling can become more prevalent.

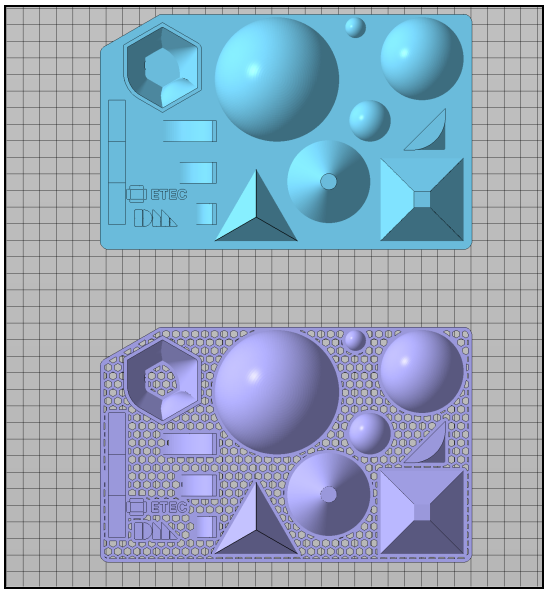
Profile of a curling part over 75 mm in length

Avoid large flat surfaces when designing parts. If that is not possible, curling can be mitigated by a number of other strategies, sometimes in combination.

Lightweighting and Perforation

If large flat areas are required for the design, modify the flat surface via one of the following methods:

- Lightweighting
- Perforation



Sample part shown with a large flat surface (top), and a perforated surface (bottom)

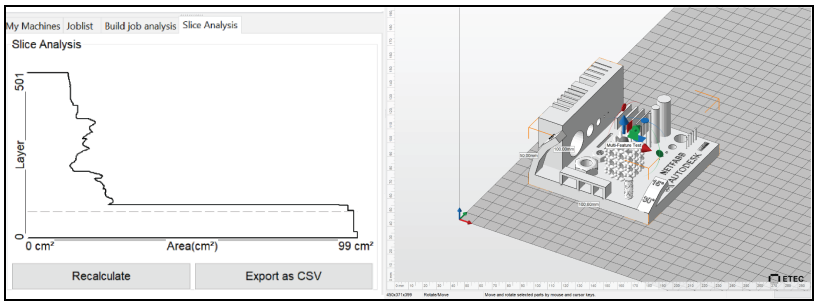
The lightweighting and perforation reduce the surface area of the layer, which in turn makes the part behave like it is smaller and thus helps to reduce curling forces. Lightweighting and perforation also reduce material use.

Tip: 3 mm is the minimum recommended hole size for perforations.

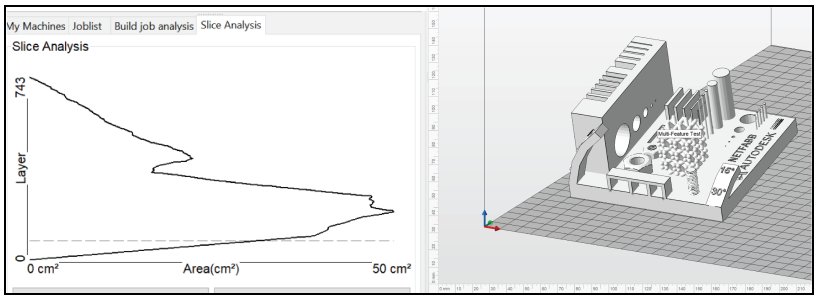
Part Orientation

Orientating the part on an angle separates the large surface area into smaller sections during the printing process. This reduces the separation forces, leading to less part curling.

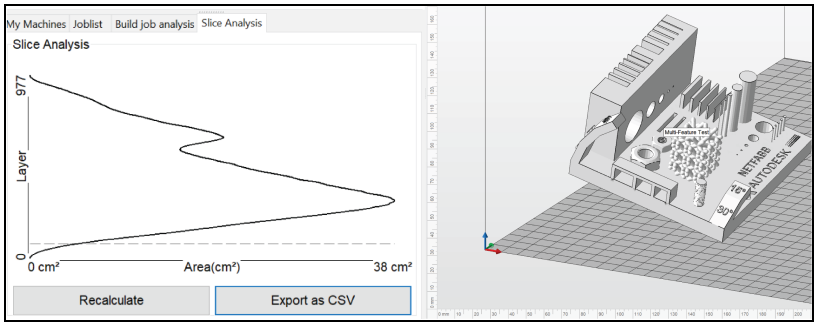
Tip: Tilt the part across two axes to further smooth out the surface area per layer curve.



Part with a large surface oriented flat-to-plate. It has a large and rapid change in area in the Slice Analysis, left



The same part rotated 15 degrees in one axis has a smoother transition between layers and lower peak value



The part rotated 15 degrees in two axis further smooths the graph while also reducing the peak exposure area

Minimum Features

The minimum resolvable feature size is dependent on:

- the printer's build envelope,
- the material,
- and the feature geometry.

Build Envelope

The build envelope is the maximum available printing space on a 3D printer. It determines the minimum and maximum objects the printer can build.

The size of the build envelope is dependent on:

- the size of the projector,
- the distance between the projector and the material vat,
- and the maximum height of the build platform in the Z axis.

Xtreme 8K Build Envelope:

Length	Width	Height
450 mm (17.72 in)	371 mm (14.61 in)	399 mm (15.71 in)

Minimum Feature Size

The Xtreme 8K build envelope has a native pixel size of 150 µm.

For all DLP technologies, the absolute minimum feature size is at least three pixels. The recommended minimum feature size is five pixels.

Xtreme 8K Minimum Feature Size:

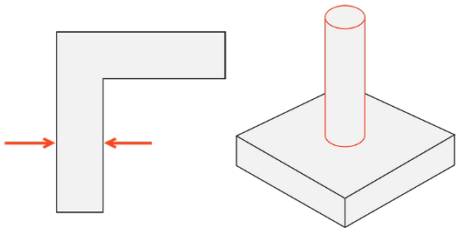
Absolute Minimum Feature Size	Recommended Minimum Feature Size
450 µm	750 µm

Note: Minimum feature size is dependent on part geometry. Testing was conducted for walls and posts at a variety of size-aspect combinations. The size tested for walls and posts was 1 mm with aspects as large as 10:1. The features were resolvable at the far end of the range, but the small size led to post-processing challenges.

Tip: For features 2 mm and smaller, keep aspect ratios below 5:1. For features over 2 mm in size, aspect ratios can increase.

Minimum Wall Thickness

Thin walls were tested at 1 mm, 1.5 mm, and 2 mm thickness. Wall sizes ranged from 5 x 5 mm to 35 x 35 mm in 5 mm increments. All tested combinations produced successful results.



Thin walls are dependent on part geometry. Walls as thin as 1 mm are likely to print but may be challenging. Walls 2 mm and above are recommended.

Note: Large fin features are delicate and may lead to post-processing challenges.

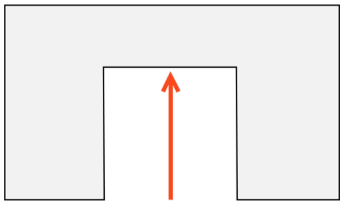
Maximum Wall Thickness

There is no maximum wall thickness for E-RigidForm on the Xtreme 8K™. The thickest wall tested was 20 mm and results were successful.

Self-Supporting Features

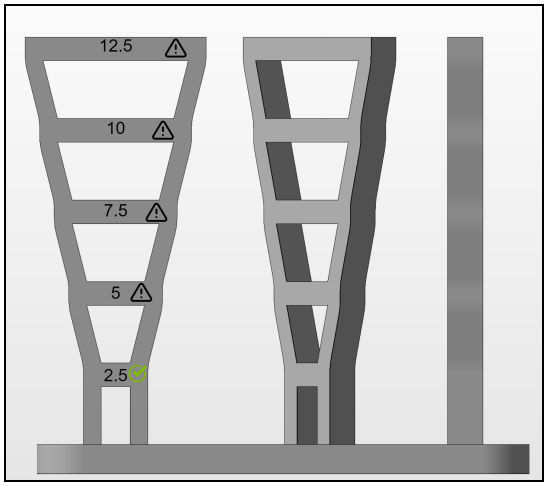
Self-Supporting Bridge

Bridging features are geometries where a span between two areas is connected by a new layer of material.



Bridge features were tested at a variety of lengths from 2 mm to 12.5 mm.

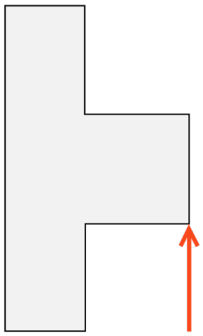
- Bridges up to 2.5 mm may be printed with no supports.
- Bridges of up to 3 mm will print successfully but some separation may occur on the bottom facing layers.
- Supports should be added to bridges over 3 mm when possible.



Test part for self-supporting bridges

Self-Supporting Overhang

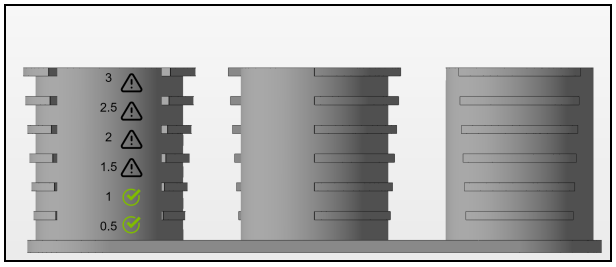
Overhanging features are printable without supports in some instances.



Self-supported overhangs were trialed from 0.5 mm to 3 mm, increasing in 0.5 mm increments.

- Overhangs up to 1 mm may be printed with no supports.
- Overhangs of up to 3 mm will print successfully but some separation may occur on the bottom facing layers.
- Supports should be added to overhangs over 1 mm when possible.

Tip: Filets and chamfers can reduce the effective overhang distance. Orientating the face of the overhang on an angle improves printability.

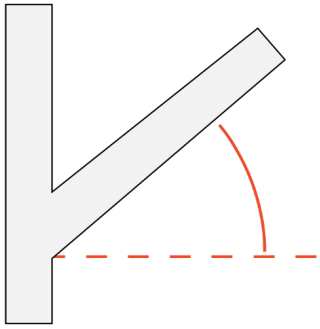


Test part for self-supporting overhangs

Self-Supporting Angles

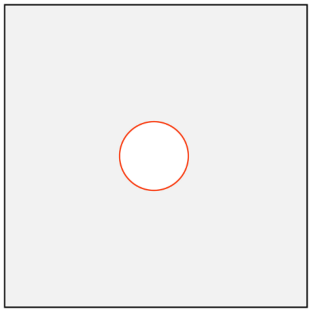
Unsupported angles as shallow as 15° from horizontal are printable. For short distances, angles this shallow may be left unsupported.

Tip: Add supports to angles 30° and under.



Self-Supporting Horizontal Hole

Horizontal holes are built during the printing process through a series of overhanging layers. The overhang distance of each layer increases slightly as the hole is built.



Holes with their primary axis in the XY plane can print without the use of supports.

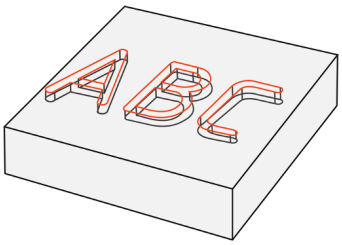
Horizontal holes are resolved as a series of increasing overhangs. If the largest overhang change is kept to 1 mm or less, then the hole may be printed with no supports.

Holes with a diameter of 25 mm or less may be left unsupported. For horizontal holes larger than 25 mm, supports are recommended. If bottom surface deformation is allowable, larger holes may be printed with no supports.

Character Height

Minimum character height differs if:

- the text is raised or recessed, and
- the text is placed on a surface that is vertical or horizontal to the Z axis.



Character heights should have line weights of at least 1.5 mm.

When working with character heights near 3 mm, bold fonts can add definition and legibility.

Tip: Character height is dependent on the minimum feature size.

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