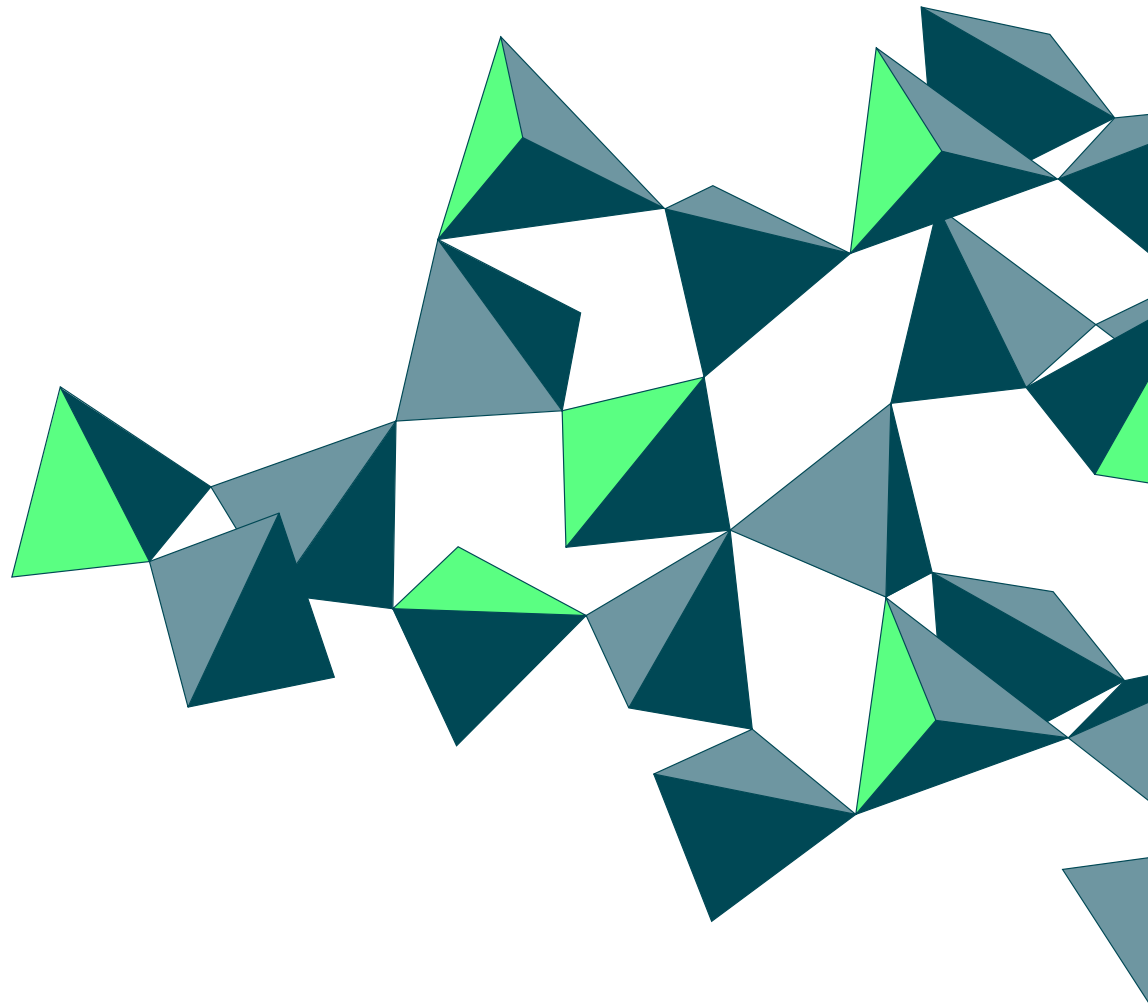


General Design Guidelines





General

ACEO® is a 3D print service provider, that prints and delivers parts directly from CAD files. ACEO® is a registered trademark of Wacker Chemie AG.

ACEO®'s 3D printing with silicones technology is based on a drop-on-demand principle. Parts are built layer by layer with this additive manufacturing process, resulting in a layered structure which is typical for this kind of process.

To achieve an optimal print quality, the printing strategy as well as the orientation on the build platform is defined by ACEO®.

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Requirements for CAD Files

Designing for optimal print quality

The guidelines in this document are intended to help developers design their parts in order to achieve the best print results¹.

General Design Guidelines

Introduction

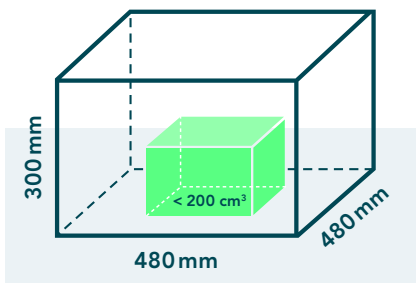
Designing a Model

Visual Appearance

Quality

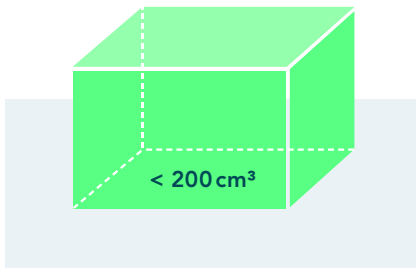
Available Silicone Elastomers

Requirements for CAD Files



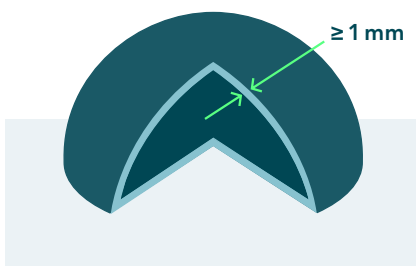
Build platform

The ACEO® Print Fab provides a maximum printing area of 480 mm x 480 mm (XY) and a maximum printing height of 300 mm (Z).



Bounding Box

The ACEO® Print Fab readily accepts digital models that have a bounding box of up to 200 cm³. For bigger part designs please submit a manual request or contact ACEO®'s service.



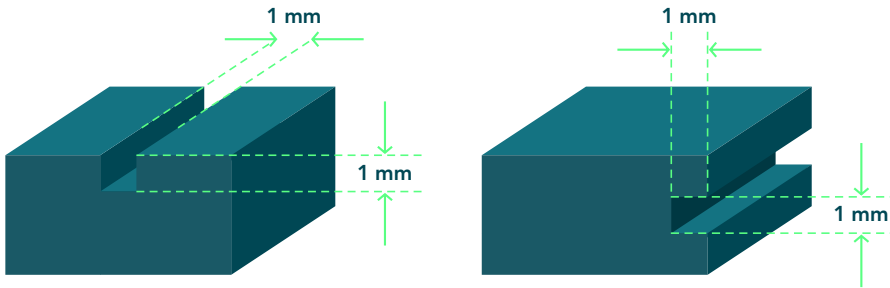
Wall Thickness

Wall thicknesses generally need to be ≥ 1 mm. In case of flat surfaces (XY) smaller wall thicknesses may be feasible.

¹ The information in this document is provided for general information only. It does not constitute a legally binding agreement and does not define the quality of the ordered product.

Spacings

For gaps, openings etc. we generally recommend spacings ≥ 1 mm.



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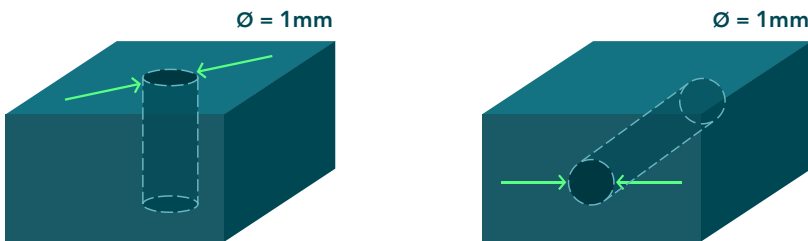
Quality

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Holes

Holes generally need a diameter ≥ 1 mm to ensure the hole will be printed.



Outlet for Support Material

ACEO® technology allows 3D printing of parts with complex geometries such as parts with inner cavities, lattice structures, overhangs or bridges. In these cases, ACEO® uses support material in the process, which needs to be removed after printing. To be able to access the support material, an outlet needs to be designed.

For efficient removal of the support material we recommend a hole or channel with $\varnothing > 2$ mm. In addition complex or longer inner channels with dead ends should be avoided.

Visual Appearance of Printed Parts

ACEO®'s drop-on-demand technology prints parts layer-by-layer which is common for additive manufacturing techniques. In preparation for printing, the 3D model is sliced into single layers by the ACEO® software. The layer height (resolution in z-direction) can vary between 0.3 and 0.4 mm and is chosen to provide optimum print quality. Depending on the part geometry and its orientation on the build platform, different surface types may occur.

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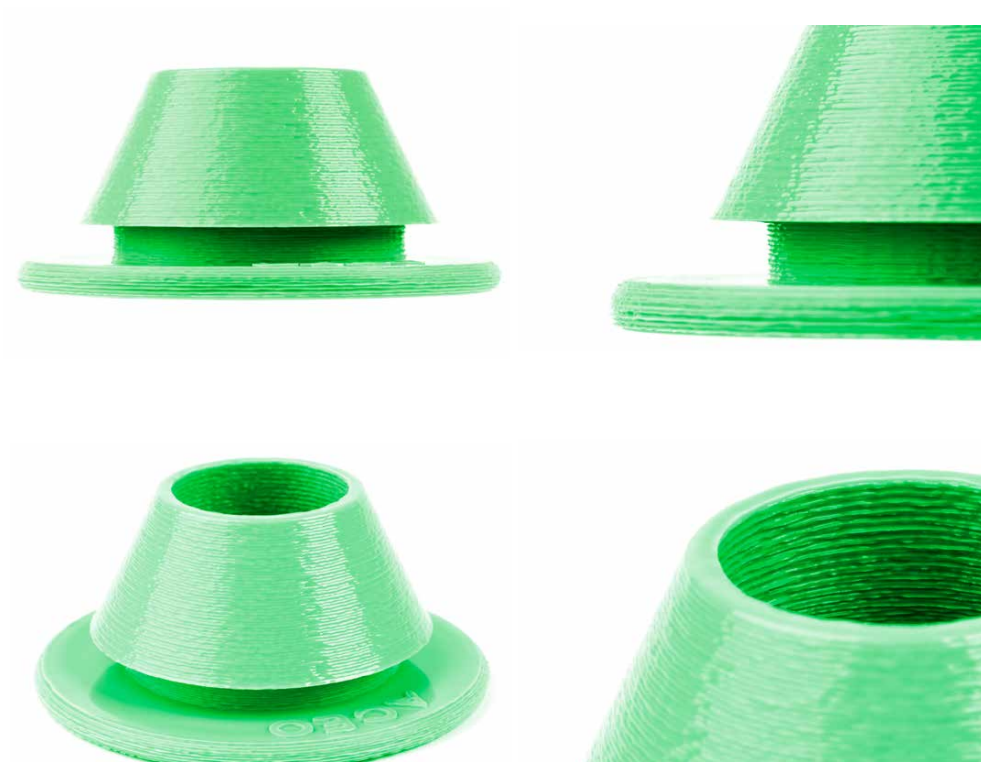
Designing a Model

Visual Appearance

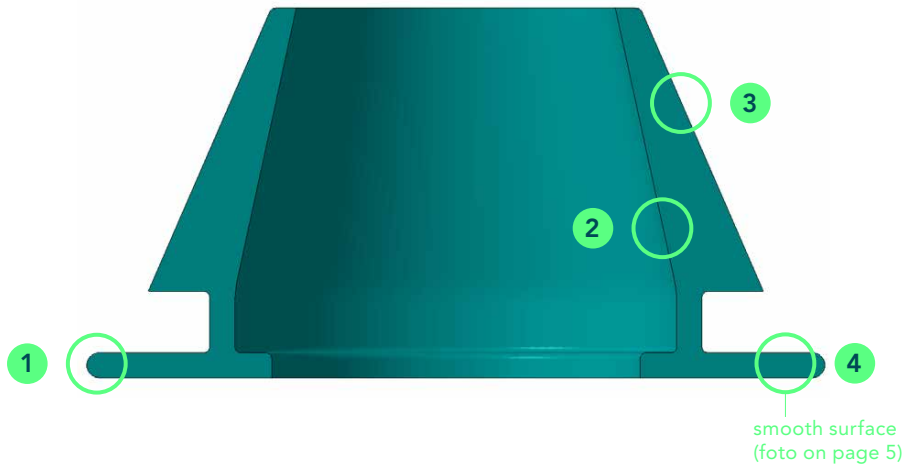
Quality

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Requirements for CAD Files



This demonstration part shows the different surface qualities resulting from drop-on-demand printing of silicones. Further details will be explained on the next page.



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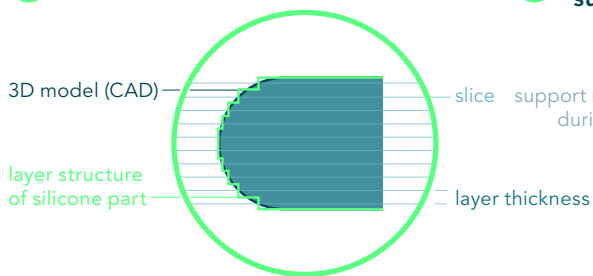
Visual Appearance

Quality

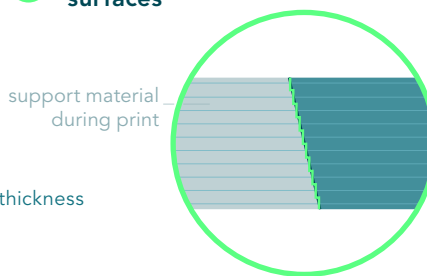
Available Silicone Elastomers

Requirements for CAD Files

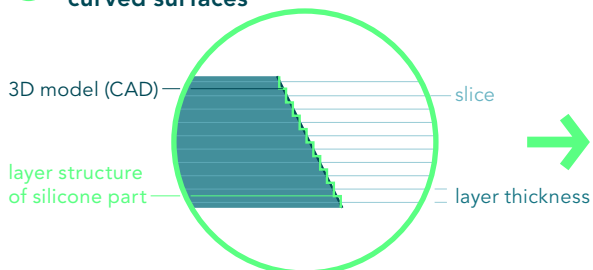
1 Round edges



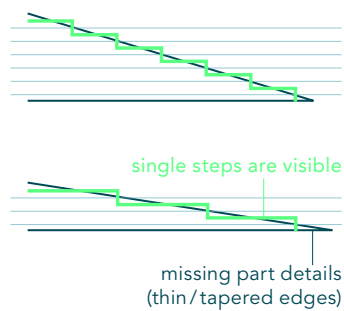
2 Supported surfaces



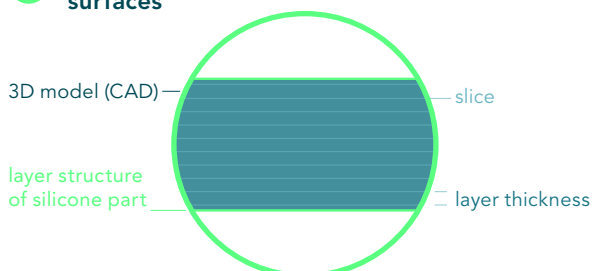
3 Slopes and curved surfaces



Different angle/slope leads to different surface quality



4 Horizontal surfaces



Visual Appearance of small Part Details

In some cases, typical designs for injection-molded parts may not provide the best results. In the below example, tapered lips are designed to allow proper demolding of the injection-molded part (see graphic on the left). When printing such design, small part details and edge radii may result in a layered appearance which may lead to poorly defined sealing lips (see graphic on the right). For additive manufacturing we recommend applying a wall thickness of ≥ 1 mm and a minimum feature size of ≥ 1 mm in order to clearly define where material is needed.

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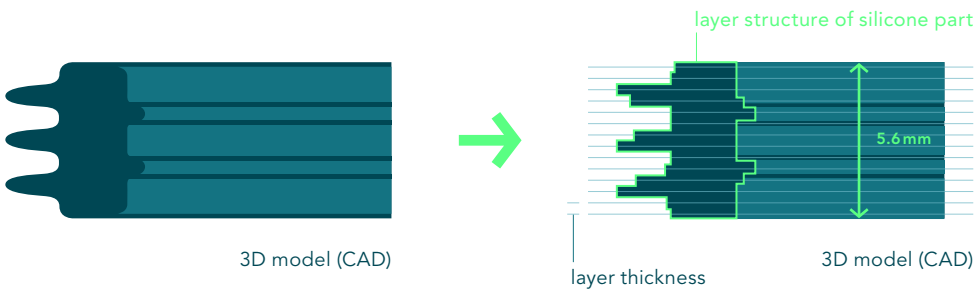
Visual Appearance

Quality

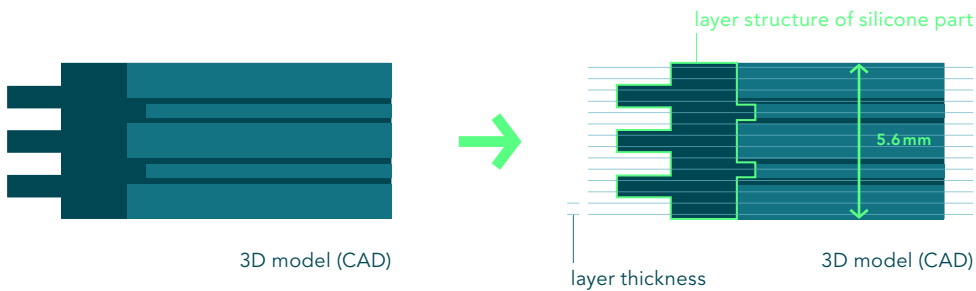
Available Silicone Elastomers

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Example of a sealing design for injection-molding



Example of a sealing design for additive manufacturing



Visual Appearance of small Part Details – e.g. letters, steps etc.

If part details such as letters or steps are smaller than the layer height, they may not be recognized by the slicer and will therefore not be printed (see graphic below). In general, we recommend our Design Guidelines of 1 mm for all small geometric features.

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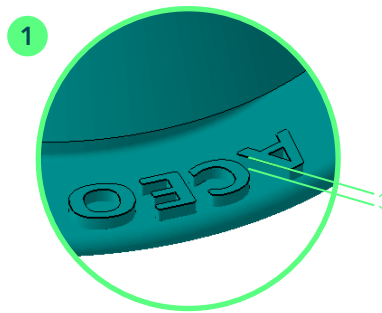
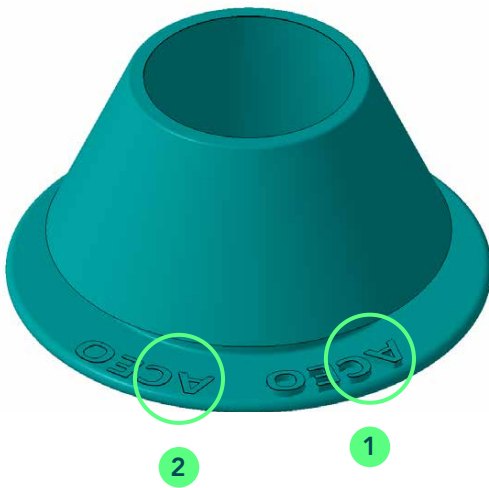
Designing a Model

Visual Appearance

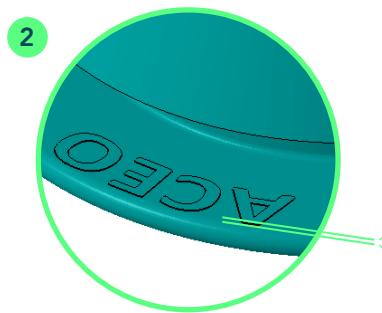
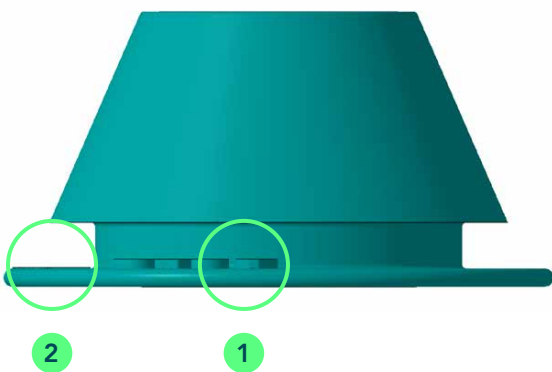
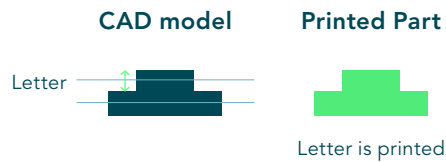
Quality

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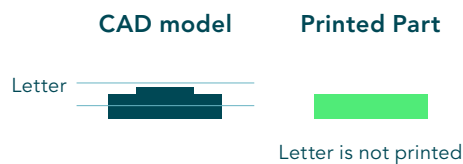
Requirements for CAD Files



Letter height > layer thickness



Letter height < layer thickness





ACEO® Quality

At WACKER we strive to keep the same high standards of quality, safety and environmental protection at all our sites worldwide. Continuous improvements to our processes, products and services are an integral part of our daily work.

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Quality Control

ACEO® performs quality control on materials and printed parts according to the WACKER quality standards.

The silicone materials used for printing are produced with the high-quality standards of WACKER SILICONES and tested according to specific test protocols.

3D printed parts are evaluated according to a defined test protocol that includes visual part inspection as well as a measurement of the dimensions and the weight.

Part Tolerances

In the length dimensions, ACEO®'s tolerances comply with the DIN ISO 2768-1 v.

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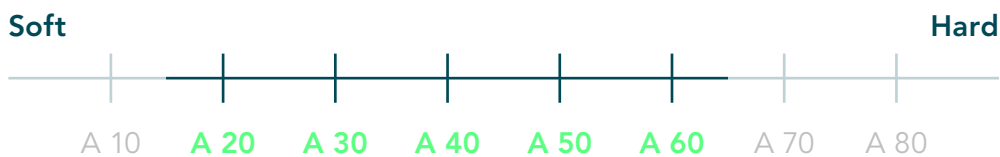
Quality

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Requirements for CAD Files


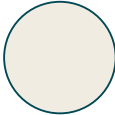
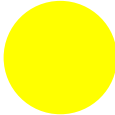







Shore A Hardness

ACEO® offers a range of different hardnesses, currently ranging from **20 to 60 Shore A**.



Available Colours

The colors listed below are part of our standard range and include translucent, skin, gentian blue and graphite black, pure white, flame red and silver gray. Some colors such as luminous yellow or grass green may need a minimum order size. For colors outside this range please contact ACEO®.

Trans- lucent	Pure White	Luminous Yellow	Pure Orange	Flame Red
				
Except for Shore A 20	RAL 9010	RAL 1026	RAL 2004	RAL 3000
Skin	Gentian Blue	Grass Green	Silver Gray	Graphite Black
				
PANTONE 7513 C	RAL 5010	RAL 6010	RAL 7001	RAL 9011

Requirements for 3D CAD Files

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We support the following formats

Preferred file formats:

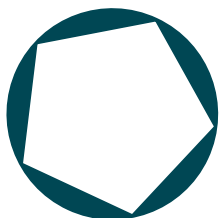
- ▶ STEP (.stp/ .step)
- ▶ STL (Standard Tessellation Language/ Stereo Lithography) (.stl)

The formats below may also be used:

- ▶ JT (.jt)
- ▶ OBJ (.obj)
- ▶ Parasolid XT (.x_t)
- ▶ PRC (.prc)
- ▶ Pro/Engineer (.prt, .asm)
- ▶ Rhino (.3dm, .rhino)
- ▶ SAT (.sat)
- ▶ Siemens PLM Software's NX (.prt)
- ▶ Solid Edge (.par, .asm)
- ▶ SolidWorks (sldprt, .prt/ .sldasm, .asm)
- ▶ Universal 3D (.u3d)
- ▶ VDA-FS (.vda)
- ▶ VRML (.wrl, .wrml)

.stl ACEO® printing technology uses .stl format, all files are converted to this format.

Tip: When you prepare your .stl file, please select a high triangulation level. This is especially valid for curves, rounds, corners, etc.



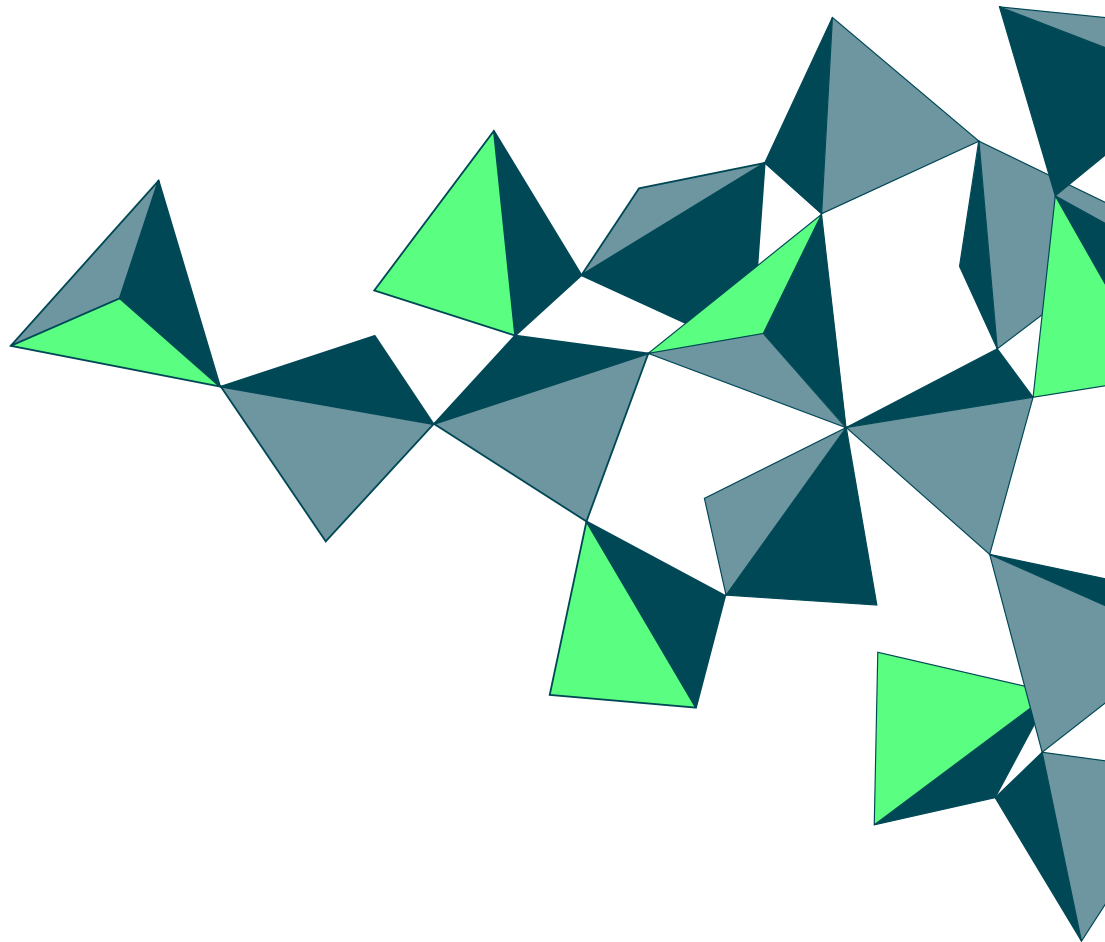
Low triangulation level



High triangulation level



IMAGINE ...
what could be your novel product design?



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