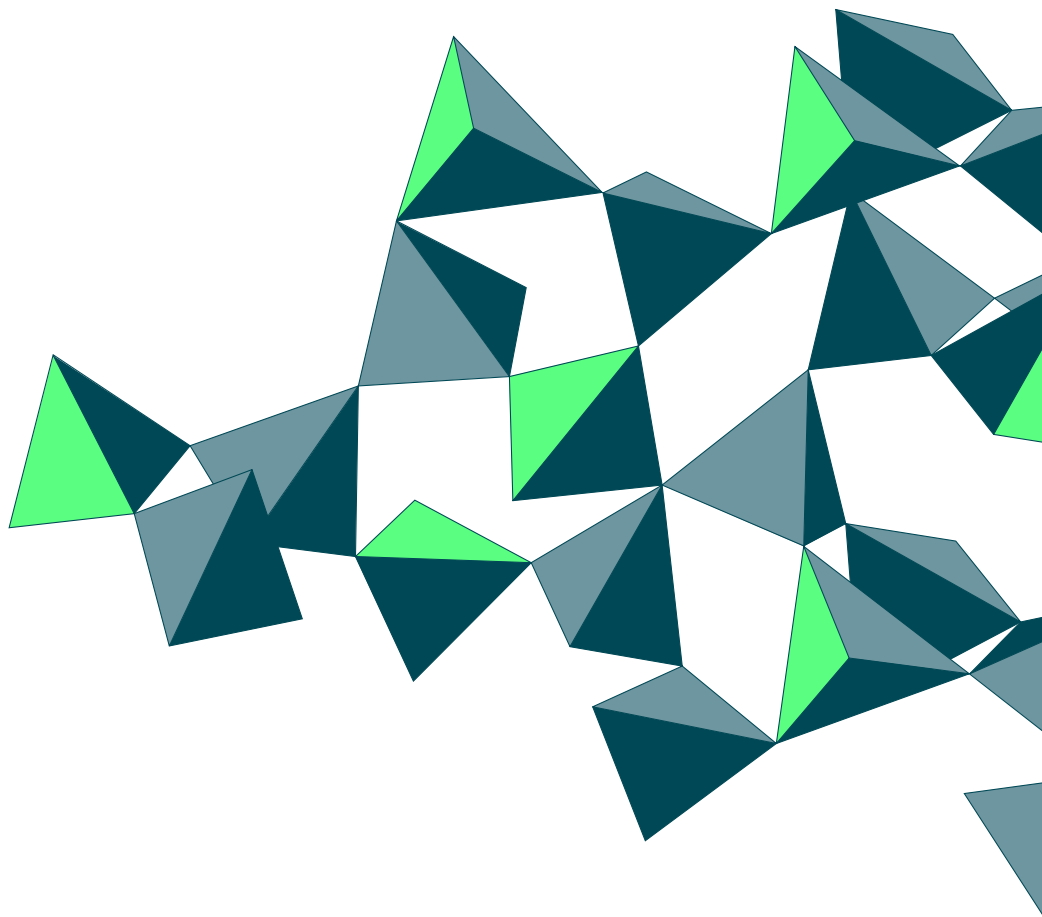


Design Guidelines





Introduction

ACEO® offers 3D printing services based on Wacker silicone elastomers.

The printing strategy as well as the orientation on the build platform is decided by ACEO® in order to achieve an optimal printing quality.

The guidelines in this document are intended for developers to achieve the best print results.

If you wish to print more than one part of a design, we recommend to get them printed in one print job to ensure the best part-to-part consistency.

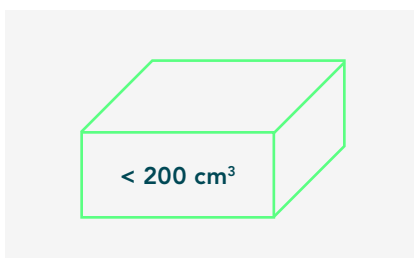
Quality of the Product

ACEO® 3D printing with silicones uses an additive manufacturing process in which parts are build layer by layer. Thus results a layered structure typical for this kind of process.

Complex structures, inner cavities, lattices etc. are filled up with ACEO® Support Material. The same applies to overhangs and bridges. After finishing the print job the ACEO® Support Material is removed. Therefore an outlet needs to be designed in order to wash the Support Material out.

Designing a Model

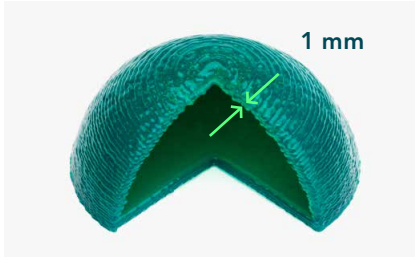
The following is provided for **general information** only. It does not constitute a legally binding agreement and does not describe the quality of the ordered product.



Bounding Box

The standard set-up of the ACEO® Print Fab accepts digital models up to a 200 cm³ bounding box.

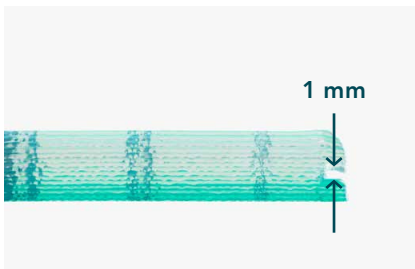
For bigger part designs please contact ACEO® at info@aceo3d.com



Wall Thickness

In order to achieve the best possible quality of the 3D printed part we recommend to design a wall thickness of at least:

1 mm



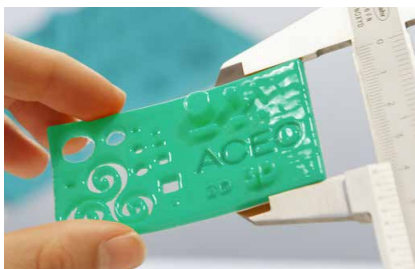
Spacings/Holes

In order to achieve the best possible quality of the 3D printed part we recommend to design spacings, of at least:

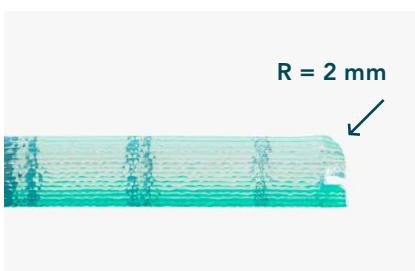
1 mm



Tolerances



The tolerances of our 3D printed parts in the length dimensions, are in line with:
DIN ISO 2768-1 v



Edge Radius

In order to achieve the best possible quality of the 3D printed part we recommend to design edge radii, of at least:

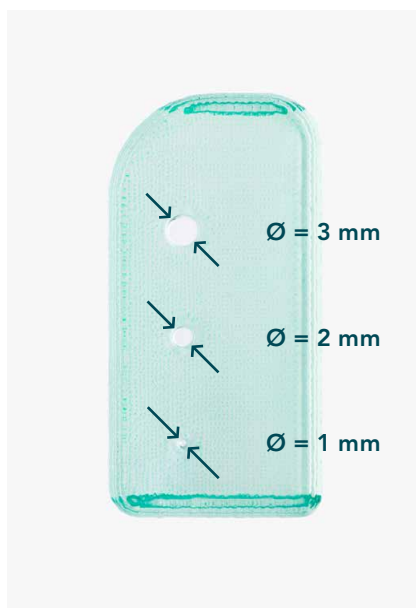
2 mm

Visual Appearance of Printed Parts

Below you will find general information on the visual appearance of parts printed with ACEO® Technology



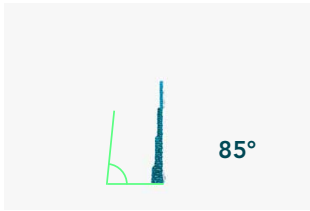
Edge Radius



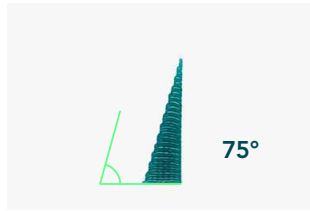
Spacings/Holes

Visual Appearance of Printed Parts (continued)

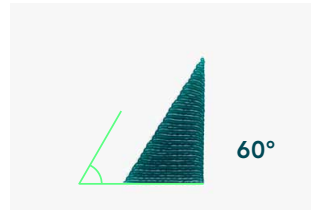
Below you will find general information on the visual appearance of parts printed with ACEO[®] Technology



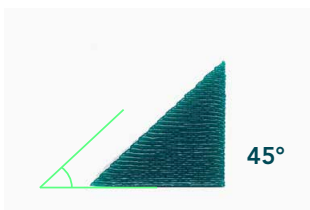
A 85 degree angle



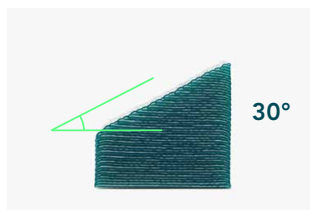
B 75 degree angle



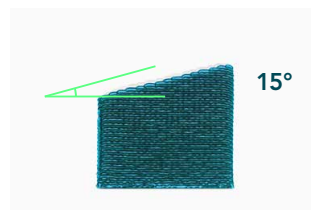
C 60 degree angle



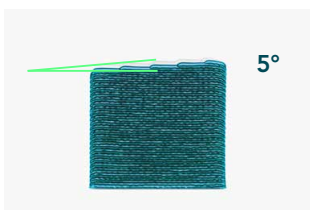
D 45 degree angle



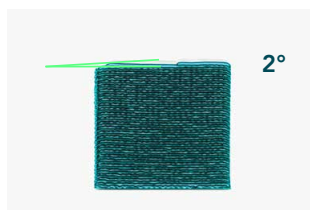
E 30 degree angle



F 15 degree angle



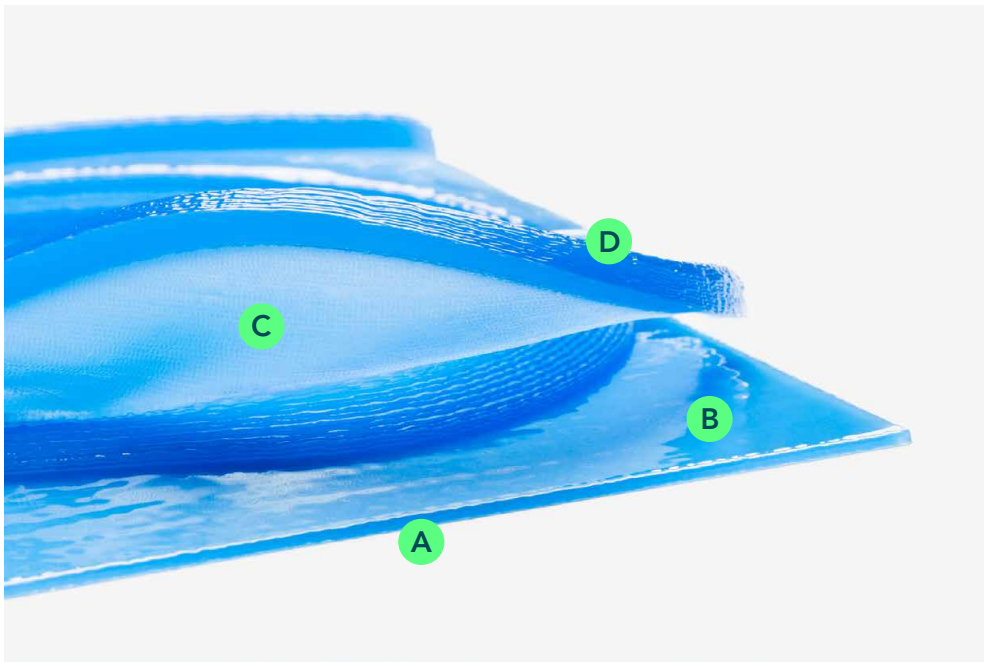
G 5 degree angle



H 2 degree angle

Visual Appearance of Printed Parts (continued)

Below you will find general information on the visual appearance of parts printed with ACEO® Technology



Surfaces

- A** Smooth bottom surface on build platform
- B** Smooth top surface from last printed layer
- C** Surface from contact to support material
- D** Side walls with layer structure, layers $\approx 0,4$ mm

Available Silicone Elastomers

Shore A Hardness

ACEO offers a range of different hardnesses, currently ranging from **20** to **60 Shore A** (**Shore A 50** coming soon)



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

We support the following formats

Preferred file formats:

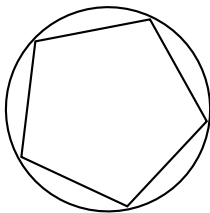
- ▶ STEP (.stp/ .step)
- ▶ STL (Standard Tessellation Language/ Stereo Lithography) (.stl)

The formats below may also be used:

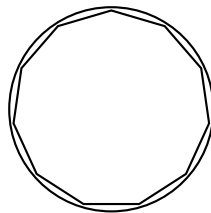
- ▶ Inventor (.ipt/ .iam)
- ▶ CATIA V4, V5, V6 (.CATPart, .CATProduct)
- ▶ Creo Parametric (.prt/ .asm)
- ▶ IFC (.ifc)
- ▶ IGES (.igs, .iges)
- ▶ JT (.jt)
- ▶ OBJ (.obj)
- ▶ Parasolid XT (.x_t)
- ▶ PRC (.prc)
- ▶ Pro/Engineer (.prt, .asm)
- ▶ Rhino (.3dm, .rhino)
- ▶ SAT (.sat)
- ▶ Siemens PLM Software's 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



Multi-Material Part Guidelines

ACEO® multi-material printing with silicones



ACEO® offers 3d multi-material printing of one part with up to four different silicones. The print process enables the combination of different hardness and/or colors.



Three materials printed in one go ...

For 3D parts that need support material, three different silicones can be used in combination with the support material.



Side view: three materials printed with support material (blue)

Any ACEO® Silicone GP material can be used. The material portfolio is described in the section “Available Silicone Elastomers” on page 7 of these Design Guidelines.

This chapter provides design guidelines for multi-material parts including tips on organizing CAD files for ordering.

General design guidelines apply

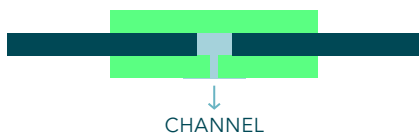
To achieve the best print results for your multi-material model, we recommend you to follow the general ACEO® design guidelines described in this document. Please note that comments on quality and visual appearance also apply to multi-material parts.

Design guidelines specific to multi-material parts

In addition to the standard design guidelines for single material parts, there are a number of things to watch for multi-material designs:



- ▶ Avoid gaps between segments – especially in z-direction – as these would be filled with support material during printing



- ▶ If gaps are intended, please make sure you design channels to allow the support material to be washed out after printing



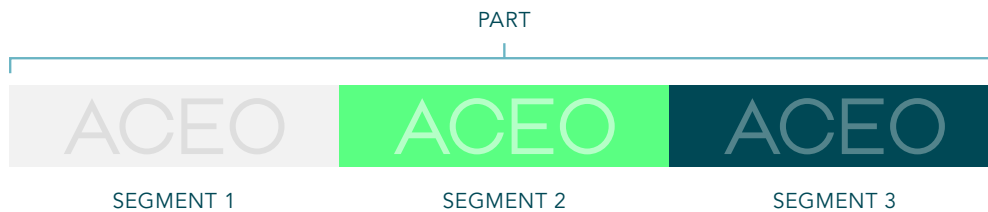
- ▶ Adjacent segments must be properly aligned to avoid unwanted gaps or overlaps and so that the edges form a uniform surface



- ▶ Misaligned segments need to be re-designed as they would cause issues during the print process

Preparing a multi-material CAD model

Definition: we define a “part” as the total printed product. A multi-material part consists of different materials for which the geometries need to be defined. For clarity reasons, we call these “segments”.



Multiple CAD Files

- ▶ Create files for each of the segments with the different material and/or color combination you desire
- ▶ You can combine multiple segments in one file as long as they represent only one material/color combination
- ▶ Create one file that contains all segments of the multi-material part. This file serves as an overview of your part and all contained segments
- ▶ Important: please make sure that your CAD-Software also exports the spatial relation between the different segments into the file. Otherwise we may not be able to reconstruct the alignment of the segments that make the part
- ▶ Export all files in “STEP” or “STL” format

CAD File Name Conventions

- ▶ Create one file that contains all segments of the multi-material part, file name convention: “MM_Part_<your file name>.ext”



- ▶ This file serves as an overview of your part and all contained segments
Example: MM_Part_MyTestFile.STL

- ▶ Create files for each of the segments, file name convention: "MM_Segment_0X_<Hardness>_<Color>_<your file name>.ext",
- ▶ Where "0X" stands for the segment number sequence like 01, 02, etc.
Example:



MM_Segment_01_ShoreA40_White_Cube.STL



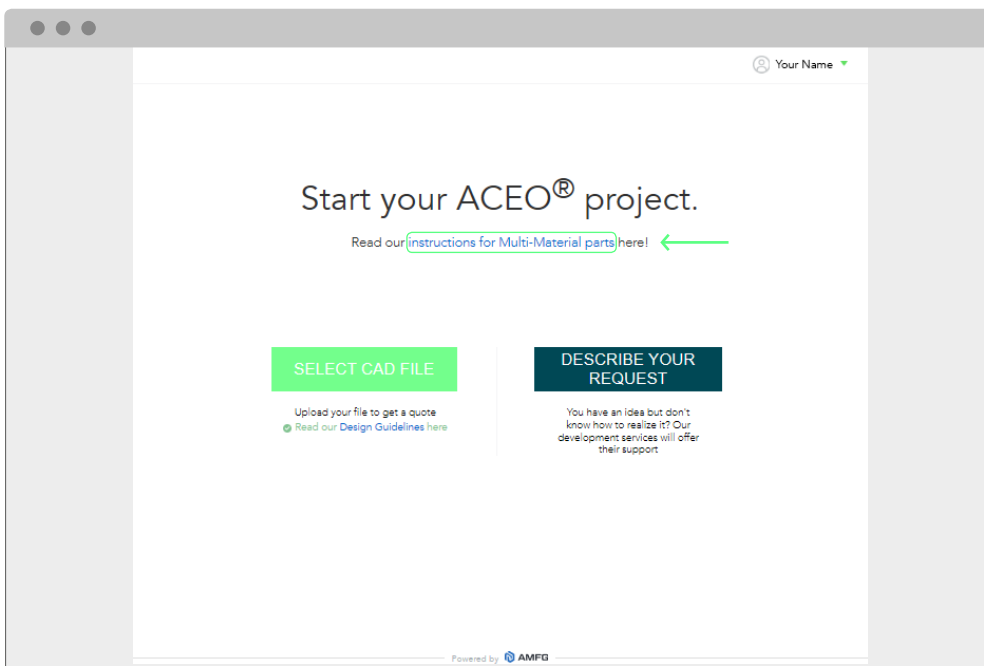
MM_Segment_02_ShoreA40_Black_Cube.STL



MM_Segment_03_ShoreA30_Orange_Cube.ST

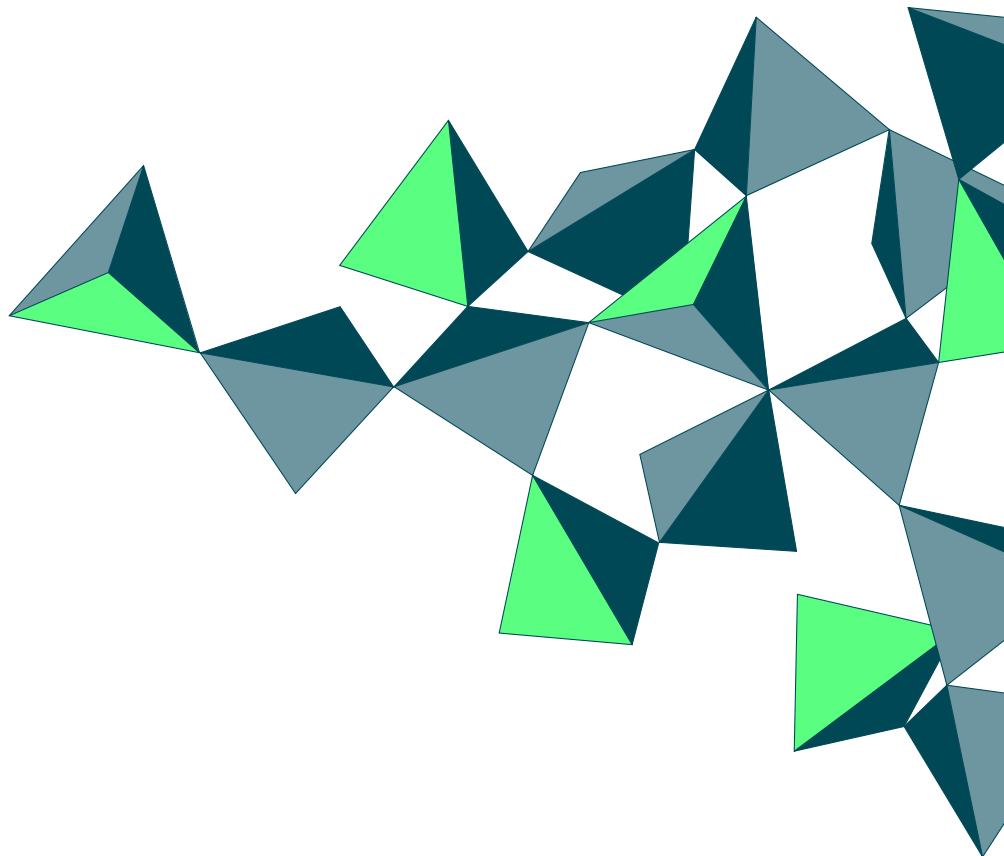
Uploading your set of files to the ACEO® web shop

When you start a new project please review our PDF document with instructions how to order a multi-material part. This document can be downloaded from the web shop start screen (see screen shot below) and provides information on how to prepare your CAD files and how to navigate the multi-material order process





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



Contact ACEO® Team

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