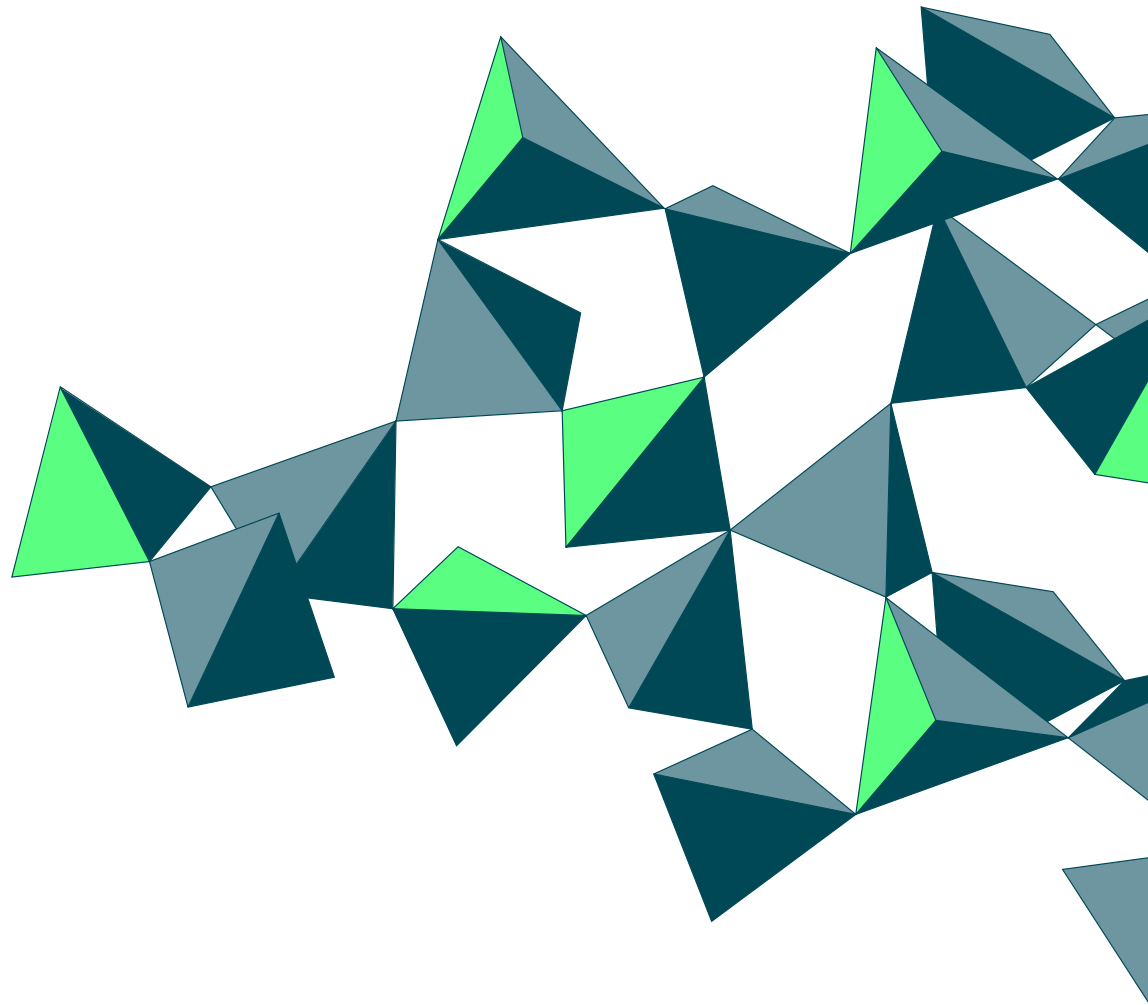


Multi-Material Guidelines – Hard/Soft Combinations



Multi-Material Part Guidelines

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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 10 of the General 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 ACEO® guidelines described in the General Design Guidelines document. Please note that comments on quality and visual appearance also apply to multi-material parts.

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Design Guidelines specific to multi-material silicone 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

Design Guidelines specific to multi-material parts for hard/soft combinations

ACEO® offers a unique multi-material option, which allows silicone elastomers to be printed in combination with epoxy thermoset material. The technology uses DELO's Katiobond AM6677 grade that has been optimized for printing with ACEO's drop-on-demand process. With this technology it is possible to realize complex 3D geometries where DELO's epoxy material provides strength and stiffness whereas ACEO's silicones provide softness and elasticity – in one print. There is no adhesion between the two materials which means that they can be easily separated after use. This also means that the design needs to provide for mechanical anchoring between the two material segments to ensure part integrity. Please note the following design guidelines for hard/soft combinations:

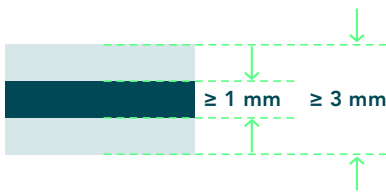
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- ▶ Standard and multi-material design guidelines apply
- ▶ Minimum wall thickness for both the silicone and the hard material is 1 mm
- ▶ There is no chemical adhesion between the hard and the soft materials and so mechanical anchoring between both segments is needed
- ▶ Normally this means that the epoxy is largely encapsulated by the silicone
- ▶ For encapsulation, a minimum thickness of the total part of 3 mm is necessary to cover the hard segments from both sides with a silicone layer of 1 mm
- ▶ Particularly for an air-tight assembly, encapsulation of the hard segment in silicone should be preferred
- ▶ Note: hard/soft prints may have longer lead times vs. silicone-only parts

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”.

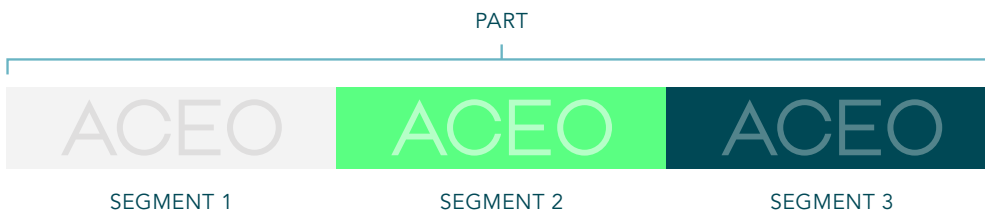
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Multiple CAD Files

- ▶ 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

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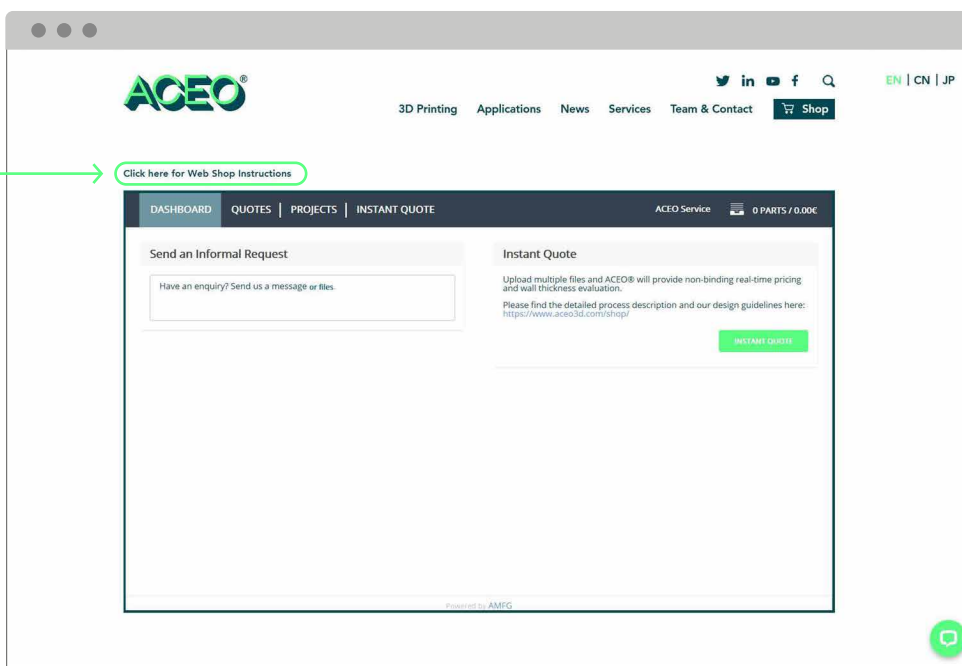
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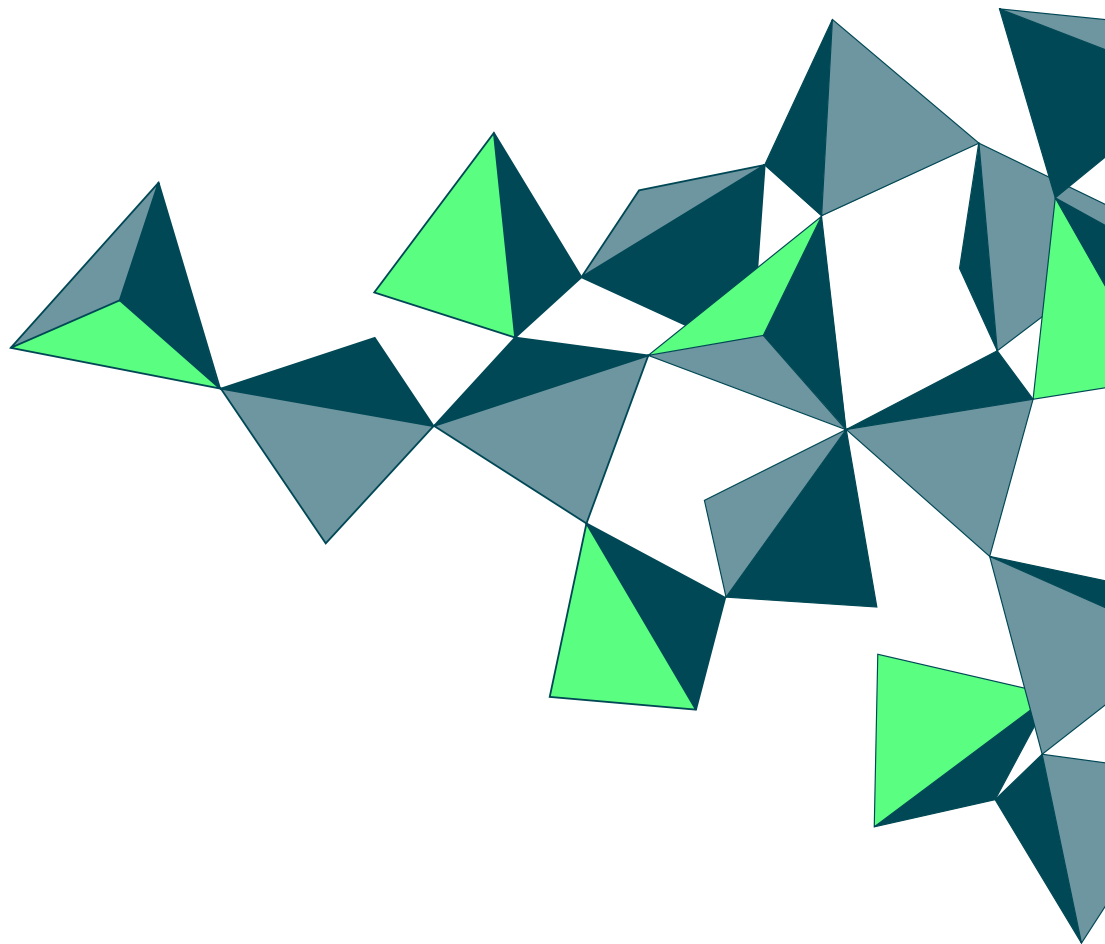
Uploading your set of files to the ACEO® web shop

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?



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