

# Soft ToughRubber™ from Adaptive3D Material Best Practice



# Table of Contents

<b>Document Information</b> .....	<b>3</b>
Legal Notice .....	3
History of Changes .....	3
How to Use This Guide .....	3
<b>About Soft ToughRubber</b> .....	<b>4</b>
Identification.....	4
Applicable Printers .....	4
<b>Getting Started</b> .....	<b>5</b>
Primary Supplies .....	5
Design Parts for Soft ToughRubber .....	5
<b>Software</b> .....	<b>8</b>
Orient Parts in Envision One RP Software.....	8
Support Parts with Envision One RP Software.....	8
<b>Print Preparation</b> .....	<b>9</b>
Fill Material Vat .....	9
Print with Soft ToughRubber.....	9
<b>Post-Processing</b> .....	<b>10</b>
Materials Safety .....	10
Clean Printed Parts.....	10
Dry Parts .....	11
Post Cure Printed Parts .....	11
Anneal Parts.....	12
<b>Manufacturer</b> .....	<b>13</b>

# Document Information

## Legal Notice

This document contains information that is confidential and proprietary to Desktop Metal, Inc. and/or its affiliates, including without limitation EnvisionTEC US LLC and ExOne Operating, LLC (each a “DM Company,” and together the “DM Companies”). This information is provided only to authorized representatives or customers of the DM Companies, and solely for the purpose of facilitating the use of DM Companies’ products and services. This document and its contents shall not be used or distributed for any other purposes or communicated, disclosed or copied except as agreed by a DM Company in writing.

The information contained herein is provided for reference only and subject to change without notice. This document provides general information about the products described herein and is not a substitute for the Instructions For Use and Safety Data Sheets for said products. The DM Companies shall not be liable for omissions or for technical or editorial errors contained herein or for any damages whatsoever arising in connection with the furnishing or use of this document. This information is not intended to be used to determine the suitability or reliability of the user’s specific applications or environments; these determinations are the sole responsibility of the user, and the DM Companies disclaim all liability associated therewith. Without limiting the foregoing, the user is solely responsible for the use and operation of the products and services, including the disposal of waste products in connection therewith.

This document does not supplement, replace or otherwise modify the terms and conditions that govern the purchase and sale or use of DM Companies’ products or services.

Furthermore, nothing herein shall constitute a warranty; the only warranties for DM Companies’ products and services are those set forth in the express warranty statement in the terms and conditions of sale for said products and services.

Desktop Metal, the DM Logo, Bound Metal Deposition, BMD, Live Parts, Studio System, Shop System, Fabricate, Fiber, Production System, Desktop Health, Desktop University, Flexcera, Einstein and ETEC are trademarks of Desktop Metal, Inc. EnvisionTEC, Envision One, cDLM, Vida, Perfactory, D4K, Hyperprint and Xtreme 8K are trademarks of EnvisionTec GmbH and its affiliates. ExOne, the ExOne Logo, Innovent, Innovent+, InnoventX, X25Pro, X160Pro, X1, S-Max, S-Print, CleanFuse, NanoFuse, and HydroFuse are trademarks of ExOne Operating, LLC or its affiliates. All other trademarks used herein are the property of their respective owners. © 2022 Desktop Metal, Inc. All rights reserved.

Soft ToughRubber Material Best Practice Guide: STR-MBP-00019-Rev01-EN, November 2022

## History of Changes

Date	Changes	Version
November-2022	Document creation	1.0

## How to Use This Guide

This document serves as a comprehensive guide to prepare parts, post-process, and finish using Soft ToughRubber.

# About Soft ToughRubber

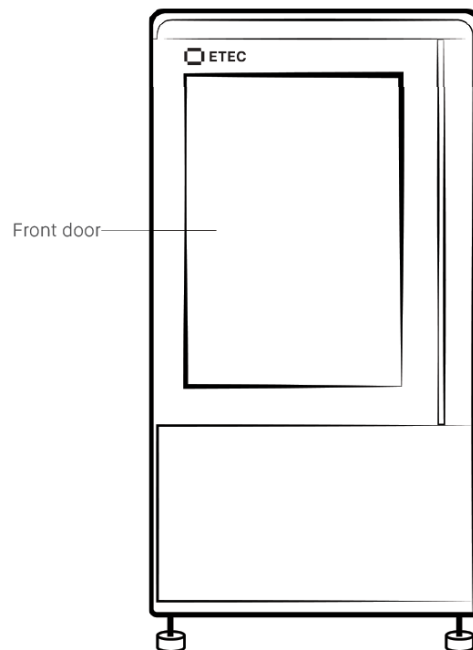
## Identification

Elastic ToughRubber™ (STR) delivers the feel and mechanical properties of silicone with the ability to be 3D printing at high resolution with amazing surface finish. Soft ToughRubber is great for applications such as audio earbuds, wearable electronics, and anatomical medical models.

## Applicable Printers

This material is tested and approved for the following printer:

- Xtreme 8K



*Fig. 1 Xtreme 8K Front View*

# Getting Started

## Primary Supplies

The following supplies are required to print STR material:

- Nitrile gloves.
- Paper towels.
- Razor scraper, *Starter Kit item*.
- Mixing blade or an industrial spatula.
- **Process Option 1:** Glycol Ether & 99% Isopropyl Alcohol (IPA).
- **Process Option 1:** Washing unit: 40kHz Sonicator & Orbital shaker.
- **Process Option 2:** 99% Isopropyl Alcohol (IPA), Potassium Carbonate, & Hydrogen Peroxide.
- **Process Option 2:** Washing unit: Orbital shaker.
- Desktop Metal's Shop System Drying Oven.
- Curing unit: UVCA 3000 *SAP Part # ACC-02-1000*.



**Important:** See the [Xtreme 8K Site Prep](#) for more information on the recommended accessories.

## Design Parts for Soft ToughRubber

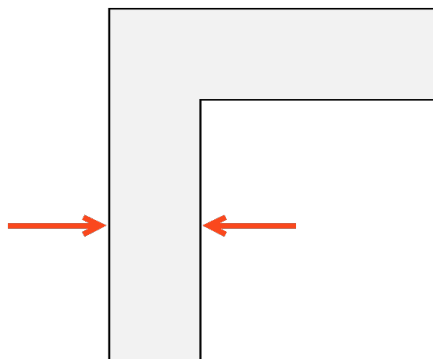


**Tip:** To improve the part removal process, place parts with large flat areas on supports rather than on the build platform.

It is recommended to add channels or drainage holes to hollow parts. This allows uncured material to drain from the hollow feature during the printing process.

### Minimum Wall Thickness

Parts printed in STR must have a minimum wall thickness of 0.45 mm.



*Fig. 2 Minimum Wall Thickness*

### Minimum Feature Size

Minimum feature size is dependent on:

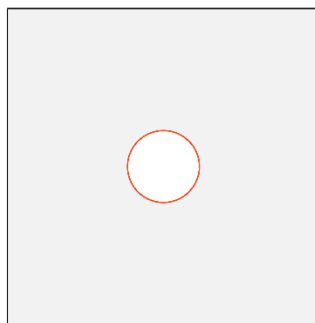
- The specific printer,
- The material,
- And the feature geometry.



**Important:** Minimum feature sizes are only valid for smaller features within the part geometry (Ex: text, small channels, etc.). Minimum feature sizes should not be used for the main components of design methodology.

ETEC recommends the following minimum feature sizes for parts printed in STR:

Design Features	Recommended Minimum
Engraving Depth (XY)	0.15 mm
Engraving Depth (Z)	0.15 mm
Embossing Height (XY)	0.15 mm
Embossing Height (Z)	0.15 mm
Positive Features (XY)	0.30 mm
Positive Features (Z)	0.30 mm
Negative Features (XY)	0.30 mm
Negative Features (Z)	0.30 mm
Unsupported Walls	0.45 mm
Supported Walls	0.30 mm
Clearance Between Mating Features	0.45 mm
Hole Diameter	1.00 mm
Wire Size	0.60 mm



*Fig. 3 Minimum Hole Diameter*

### Lattice Design

Lattice structures are comprised of cells and struts. The recommended cell size is dependent on the strut size, and vice versa.

Body-centered cubic (BCC) lattice size recommendations:

	Strut: 0.50 mm	Strut: 0.75 mm	Strut: 1.0 mm	Strut: 1.5 mm	Strut: 2.0 mm
Cell: 2.0 mm					
Cell: 4.0 mm		4.0 x 0.75 mm recommended	4.0 x 1.0 mm recommended		
Cell: 6.0 mm			6.0 x 1.0 mm recommended	6.0 x 1.5 mm recommended	6.0 x 2.0 mm recommended
Cell: 8.0 mm			8.0 x 1.0 mm recommended	8.0 x 1.5 mm recommended	8.0 x 2.0 mm recommended

Cell: 12.0 mm			12.0 x 1.0 mm recommended	12.0 x 1.5 mm recommended	12.0 x 2.0 mm recommended
------------------	--	--	------------------------------	------------------------------	------------------------------

One inch cell size lattice type recommendations:

		Cell Type				
Volume Fraction		BCC	Fluorite	Truncated Cube	Kelvin Cell	HCP
	4%	2.24 mm	1.60 mm	1.93 mm	1.85 mm	1.40 mm
	5%	2.52 mm	1.80 mm	2.18 mm	2.08 mm	1.57 mm
	10%	3.62 mm	2.59 mm	3.15 mm	3.00 mm	2.26 mm
	15%	4.49 mm	3.23 mm	3.95 mm	3.73 mm	2.81 mm
	20%	5.24 mm	3.78 mm	4.65 mm	4.37 mm	3.28 mm
	30%	6.55 mm	4.75 mm	5.91 mm	5.49 mm	4.12 mm
	50%	8.76 mm	6.46 mm	8.16 mm	7.43 mm	5.55 mm



**Note:** During testing, the unit cells were arrayed in 2 x 2 x 4 in samples. The strut size is shown in each cell above.

### Self-Supporting Angle

The maximum self-supporting angle for parts printed in STR is 75° from horizontal. Angles as shallow as 30° may be printed without supports, but some deformation can occur.

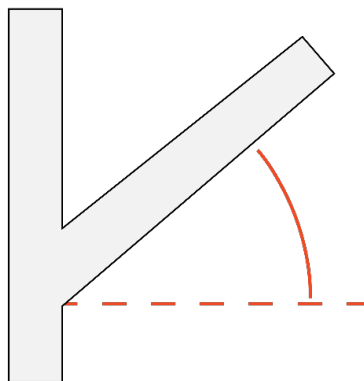


Fig. 4 Self-Supporting Angle

### Unsupported Overhang

The maximum unsupported horizontal overhang for parts printed in STR is 1.00 mm.

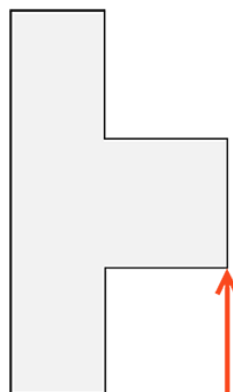


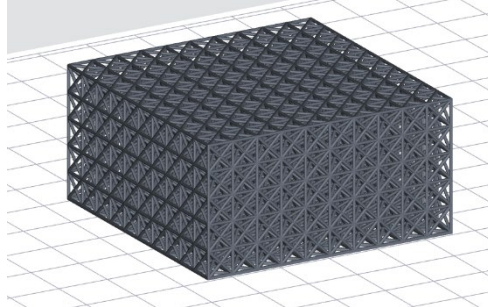
Fig. 5 Unsupported Horizontal Overhang

# Software

## Orient Parts in Envision One RP Software

Envision One RP automatically orients your model, adds supports, if necessary, and sends the file to the printer, resulting in your three-dimensional model. Everything that is printed using ETEC printers must pass through this software successfully.

- **Spacing:** Place parts a minimum of 2.0 mm apart.
- **Level at build platform:** Place unsupported parts directly on the build platform. Place supported parts 10.0 mm from the build platform.
- **Resolution:** 150  $\mu$ m Z resolution (dependent on layer thickness).

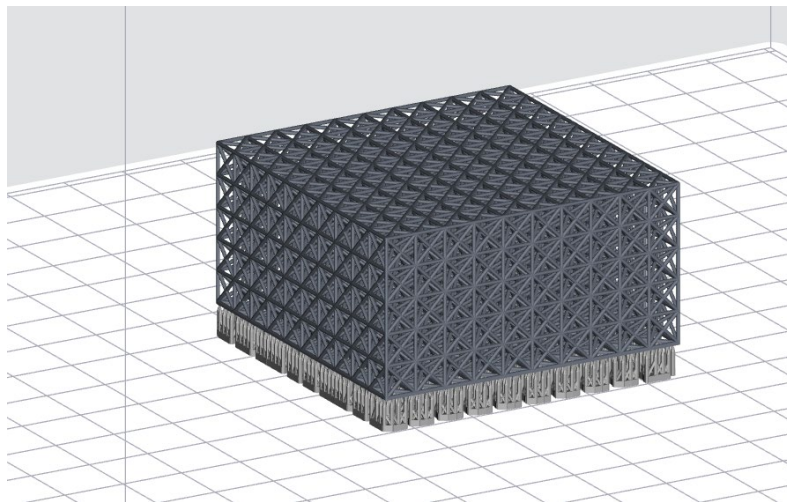


*Fig. 6 Unsupported Part in Envision One RP Software*

## Support Parts with Envision One RP Software

Some approved applications require supports. Always use the STR.ini support file:

- **Minimum support base:** 1.6 mm
- **Minimum contact tip:** 0.50 mm
- **Minimum support beam height:** 10.0 mm



*Fig. 7 Supported Part in Envision One RP Software*



# Print Preparation

## Fill Material Vat

Do not overfill the material vat. Overfilling can cause the material to overflow at the start of the print job.



**Important:** Ensure there are no small, cured particles in the material. See [Maintain Materials Xtreme 8K](#).

Mix material in the vat with a mixing blade or an industrial spatula for a minimum of 2-3 mins. The material should be a uniform color.

Material is automatically added to the material vat by the resin reservoir. See the [Knowledge Base](#) for more information.

## Print with Soft ToughRubber

Before starting a print:

1. Ensure the build platform is clean and free of cured material.
2. Ensure the material level is correct.
3. Check the build platform level.
4. Check the recoating blade gap.

To start the print, follow instructions in the printer's Operations and Maintenance Guide.

To remove the parts from the build platform after the print is complete, follow instructions in the printer's Operations and Maintenance Guide. See the [Knowledge Base](#) for the latest guide.




**Tip:** To remove parts, place the razor scraper under one corner of the part and gently pry the part from the build platform. More contact between the part and the build platform increases the difficulty of part removal.

# Post-Processing

## Materials Safety

Safety data sheets (SDS) for materials used in the printing process are available either from [ETEC](#) or directly from suppliers. Read and understand the information provided in these documents prior to attempting to operate the printer or handle any media.

 Warning	<b>Fire hazard:</b> Some materials used for washing may be flammable. Do not wash parts in proximity of any potential ignition source. Washing or drying equipment must be approved for use with flammable solvents. Read the SDS and contact your EHS Representative.
--	--

## Clean Printed Parts

Allow the material to drip off parts before cleaning. Then, immediately remove and clean parts. Always wear gloves when handling uncured material and alcohol.



**Important:** Choose one Process Option for washing and annealing. Do not switch between Process Option 1 and Process Option 2 when post processing one batch of parts.



**Important:** Do not expose STR to the washing agent for longer than 60 minutes. Excess exposure to the washing agent may cause a significant dimensional increase in the part and may cause a change in the mechanical properties.

### Process Option 1

1. Wash the part(s) in the Sonicator with Glycol Ether for 5 – 60 minutes (washing time is dependent on part geometry).
2. Remove the part(s) as soon as part washing is complete.
3. Wash the part(s) in the Orbital Shaker with 99% IPA for 1 – 10 minutes, extending time up to ten minutes based on total sonication time.
4. Remove the part(s) as soon as the program is complete.

### Process Option 2

1. Wash the part(s) in the Orbital Shaker with 99% IPA for 5 – 60 minutes (washing time is dependent on part geometry).
2. Remove the part(s) as soon as part washing is complete.
3. Wash the part(s) in the Orbital Shaker with Potassium Carbonate in 99% IPA for 5 minutes.
4. Remove the part(s) as soon as the program is complete.
5. Wash the part(s) in the Orbital Shaker with Hydrogen Peroxide in water for 5 minutes.
6. Remove the part(s) as soon as the program is complete.



**Important:** A new washing solution for large parts is in development.

## Dry Parts

Parts must be completely dry before post curing:

1. Pre-heat Desktop Metal's Shop System Drying Oven to 60° C.
2. Place the parts in the oven.
3. Dry the parts for a minimum of 1 hour. Extended drying time may be required for larger parts.



**Tip:** Place parts on a solid, even surface to avoid imprints on the part surface. Parchment paper is recommended.

## Post Cure Printed Parts



**Important:** Place parts in the curing unit with as much space between parts as possible. Parts should never touch one another while curing.



**Important:** Flip parts between cycles for an even cure. Let parts cool completely before handling them or starting the next cycle.

Cure the parts using one of the following methods:

Curing Unit	Time (H:MM:SS)
UVCA 3000 See <a href="#">Hardware Operations UVCA 3000</a> .	2 x 20 Minutes

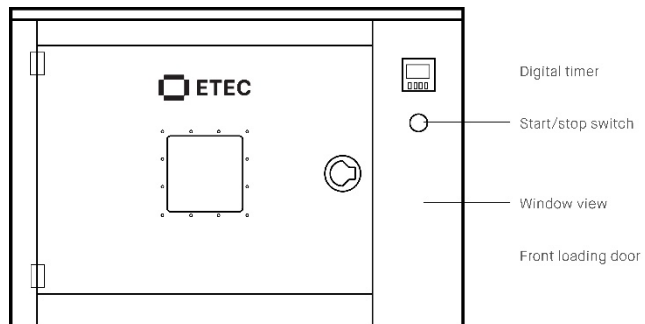


Fig. 8 UVCA 3000 Front View

## Anneal Parts



**Important:** Annealing **is required** for Process Option 1 to achieve stated material properties. Annealing is **not required** for Process Option 2 but is recommended to reduce odor in parts.



**Tip:** A 4-hour minimum (24-hour maximum) annealing time is recommended to reduce odor for odor-critical applications.

### Process Option 1

Annealing is required at:

- a minimum of 1 hour to reach intended mechanical properties,
- a minimum of 4 hours to reduce odor, and
- a maximum of 24 hours total annealing time for parts.

Step-by-step:

1. Pre-heat Desktop Metal's Shop System Drying Oven to 120° C (248° F).
2. Place the parts in the oven.
3. Dry the parts for a minimum of 1 hour.

### Process Option 2

Annealing is not required to reach intended mechanical properties. Annealing is recommended to reduce odor:

- A of minimum of 4 hours, and
- A maximum of 24 hours.

Step-by-step:

1. Pre-heat Desktop Metal's Shop System Drying Oven to 120° C (248° F).
2. Place the parts in the oven.
3. Dry the parts as desired for odor critical applications.

---

# Manufacturer

Desktop Metal, Inc.  
63 3rd Avenue  
Burlington, MA 01803  
[www.desktopmetal.com](http://www.desktopmetal.com)

Desktop Health  
c/o Desktop Metal, Inc.  
63 3rd Avenue  
Burlington, MA 01803  
[www.health.desktopmetal.com](http://www.health.desktopmetal.com)

EnvisionTEC US LLC (ETEC)  
15162 Commerce Dr. S  
Dearborn, MI 48120  
[www.etec.desktopmetal.com](http://www.etec.desktopmetal.com)

EnvisionTec GmbH  
Brusseler Str. 51  
45968 Gladbeck  
Germany

ExOne Operating, LLC  
127 Industry Boulevard  
North Huntingdon, PA 15642  
[www.exone.com](http://www.exone.com)

ExOne GmbH  
Daimlerstrasse 22  
86368 Gersthofen  
Germany

ExOne KK  
161-5 Haneo  
Odawara-shi, Kanagawa  
Japan 256-0804