Soft ToughRubber™ from Adaptive3D
Material Best Practice

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Document Information

Legal Notice

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

Front door
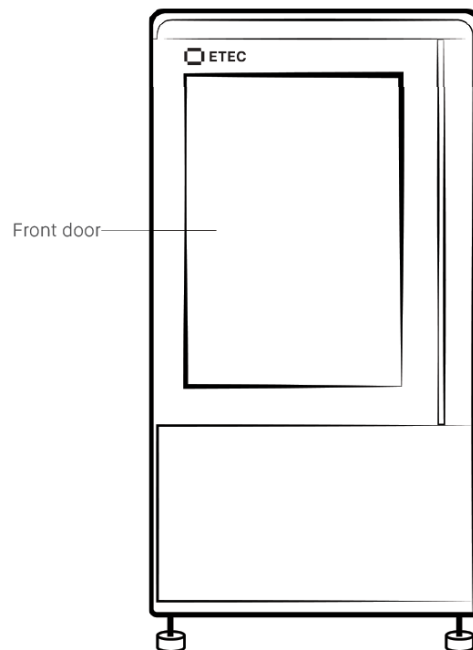
Fig. 1 Xtreme 8K Front View

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.
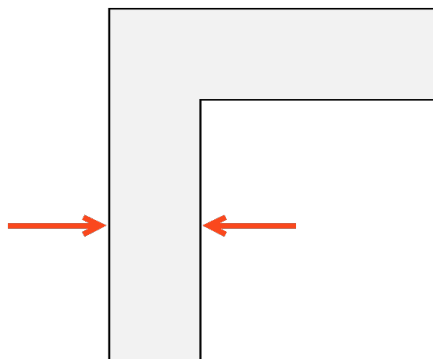
Fig. 2 Minimum Wall Thickness

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
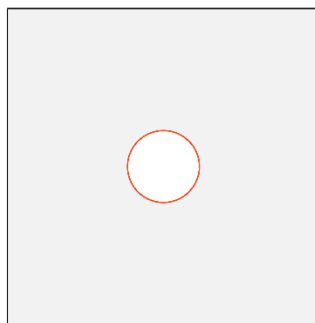
Fig. 3 Minimum Hole Diameter

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.
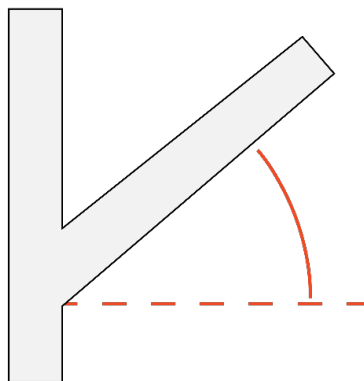
Fig. 4 Self-Supporting Angle

Unsupported Overhang

The maximum unsupported horizontal overhang for parts printed in STR is 1.00 mm.
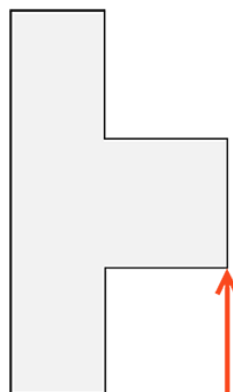
Fig. 5 Unsupported Horizontal Overhang

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 µm Z resolution (dependent on layer thickness).
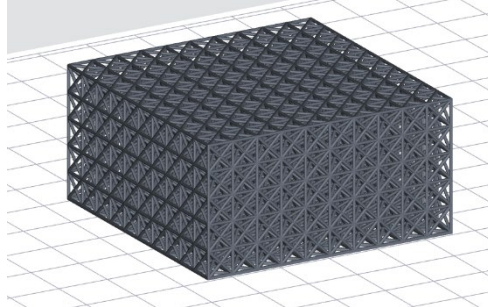
Fig. 6 Unsupported Part in Envision One RP Software

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.

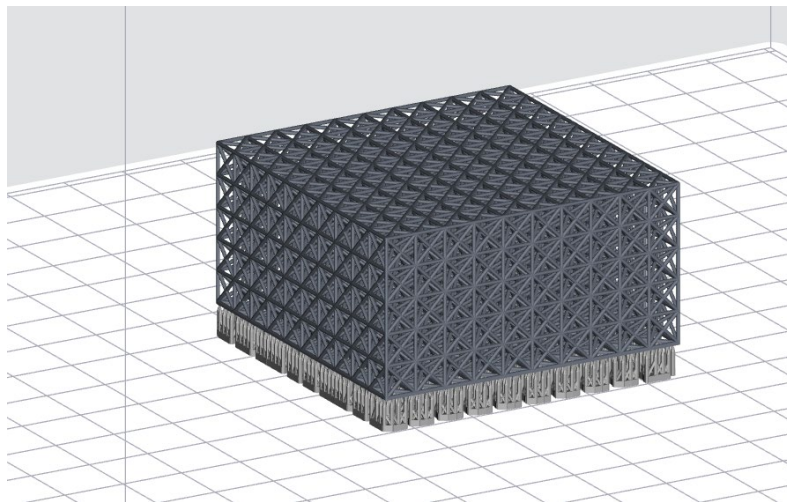Material is automatically added to the material vat by the resin reservoir. *See the [Knowledge Base](#) for more information.*

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**	**Fire hazard:** 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:

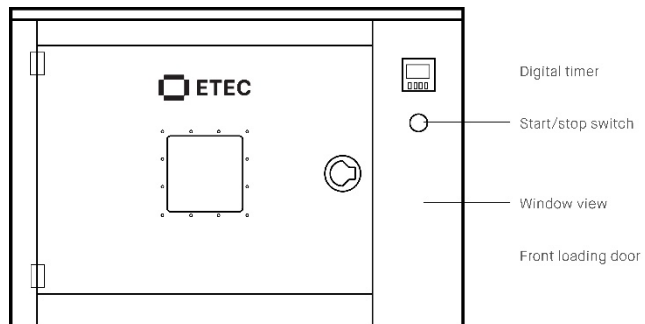| Curing Unit	Time (H:MM:SS)
UVCA 3000 *See Hardware Operations UVCA 3000.*	2 x 20 Minutes

Fig. 8 UVCA 3000 Front View

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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.

ETEC

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