Revision 2.0, March 2023

Elastic ToughRubber™ 70 from Adaptive3D Material Best Practice

ETEC

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History of Changes

Date	Changes	Revision
November-2022	Document creation	1.0
March-2023	• Updated style throughout • Updated Legal Notice • Updated About This Guide • Updated Design Parts Elastic ToughRubber 70 • Updated Support Parts Envision One RP • Updated Print Preparation • Updated Post-Processing	2.0

About This Guide

This document helps you prepare, post-process, and finish parts using Elastic ToughRubber 70 material.

Elastic ToughRubber 70 Material Best Practice Guide: ETR70-MBP-00016-Rev02-EN, March 2023

About Elastic ToughRubber 70

Identification

Elastic ToughRubber™ (ETR) unlocks the benefits of additive manufacturing for the rubber, polyurethane, and foam industries. ETR 70 has excellent elongation which makes it great for applications like gaskets and protective housings.

Applicable Printers

This material is tested and approved for the following printer:

- Xtreme 8K

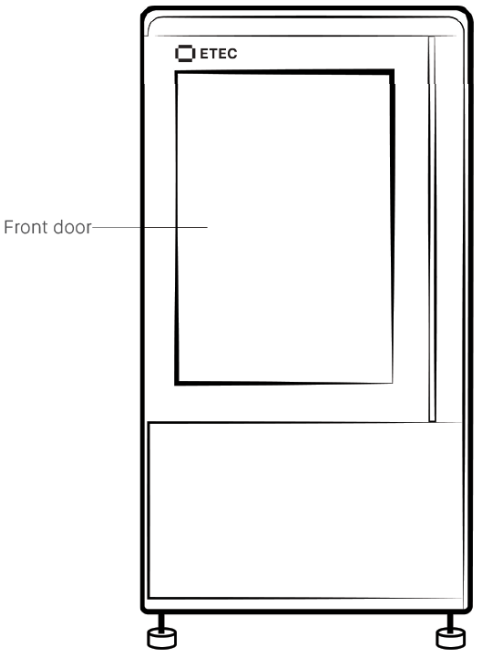

Fig. 1 Xtreme 8K Front View

Getting Started

Primary Supplies

Primary supplies should be acquired prior to product delivery. Obtain the proper tools to prepare for successful printing and post-processing.

The following supplies are required to print ETR 70 material:

- Nitrile gloves.
- Absorbent paper towels.
- Razor scraper.
- Process Option 1: Glycol Ether and 99% isopropyl alcohol (IPA).
- Process Option 1: The Orbital Shaker washing unit.
- Process Option 2: 99% isopropyl alcohol (IPA).
- Process Option 2: The Orbital Shaker washing unit.
- Desktop Metal's Shop System Drying Oven.
- Curing unit: UVCA 3000 SAP Part # ACC-02-1000.

Important: See Xtreme 8K Site Prep for more information on the recommended accessories.

Design Parts Elastic ToughRubber 70

Add channels or drainage holes to hollow parts. This allows uncured material to drain from the hollow feature during the printing process.

Large flat areas on parts must be placed on supports rather than on the build platform. Keep this in mind when designing parts for ETR 70.

Minimum Wall Thickness

Parts printed in ETR 70 must have a minimum wall thickness of 0.30 mm for unsupported walls and 0.15 mm for supported walls.

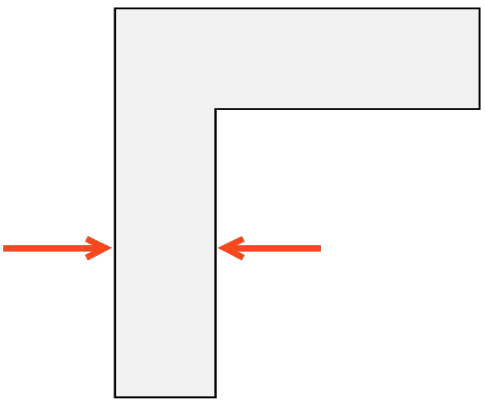

Fig. 2 Minimum Wall Thickness

Minimum Feature Size

Minimum feature size is dependent on:

- Printer
- Material
- 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 ETR 70:

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	0.30 mm
Supported Walls	0.15 mm
Clearance Between Mating Features - Squares	0.45 mm
Clearance Between Mating Features - Cylinders	0.30 mm
Unsupported Horizontal Overhang	3.00 mm **Note:** The value is max, not min.
Unsupported Overhang Angle	75°
Hole Diameter (XY)	1.85 mm
Hole Diameter (Z)	1.50 mm

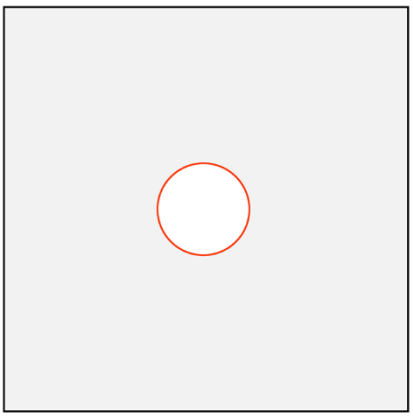

Fig. 3 Hole Diameter

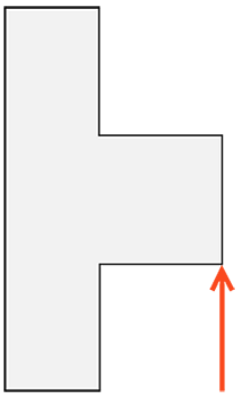

Fig. 4 Unsupported Horizontal Overhang

Self-Supporting Angle

The maximum self-supporting angle for parts printed with ETR 70 is 75° from the horizontal surface of the build platform. This means that parts at 75° or smaller angles may be printed without supports, but some deformation can occur.

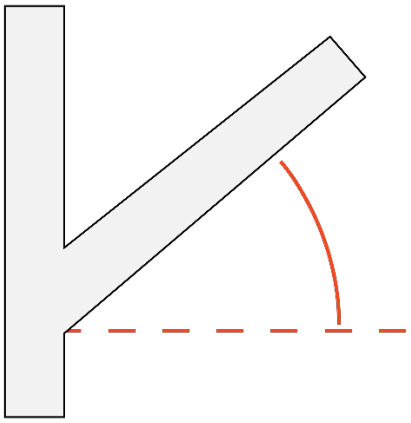

Fig. 5 Self-Supporting Angle

Lattice design

Lattice structures are used to make the 3D printed objects stronger. There are various 3rd party tools available to generate and configure lattice structures for the 3D models. For instance, Autodesk® could be effectively used to set up the lattice parameters of the 3D part.

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

Below are recommendations for body-centered cubic (BCC) lattice sizes:

	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	4.0 x 1.5 mm recommended	4.0 x 2.0 mm recommended
Cell: 6.0 mm		6.0 x 0.75 mm recommended	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 1.5 mm recommended	12.0 x 2.0 mm recommended

Below are recommendations on volume fraction for various types of lattice cells:

Cell Type	Volume Fraction						
	4%	5%	10%	15%	20%	30%	50%
Body Center Cubic			3.62	4.49	5.24	6.55	8.76
Truncated Cube					4.65	5.91	8.16
Body Centered Fluorite			2.33	2.90	3.41	4.3	5.89
Fluorite			2.59	3.23	3.78	4.75	6.76
Kelvin				3.73	4.37	5.49	7.43
Orthoplanar Spring					3.65	4.5	6
Custom				2.765	3.24	4.07	5.51

Software

Orient Parts Envision One RP

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 2.050 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).

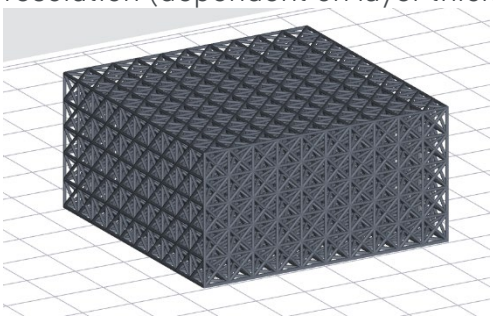

Fig. 6 Unsupported Part in Envision One RP Software

Support Parts Envision One RP

Some approved applications require supports.

- **Minimum contact tip thickness:** 0.30 mm.
- **Minimum support beam thickness:** 2.00 mm.
- **Minimum support beam height:** 10.0 mm.
- **Minimum space between supports:** 2.05 mm.
- **Support base:** The **Fence** base type is used.
- **Maximum height of support structures:** 500.00 mm.
- **Clearance from part (distance from a support beam to a surrounding model surface):** 2.00 mm.
- **Reinforcement spacing (distance between reinforcement cross bars):** 5.00 mm.

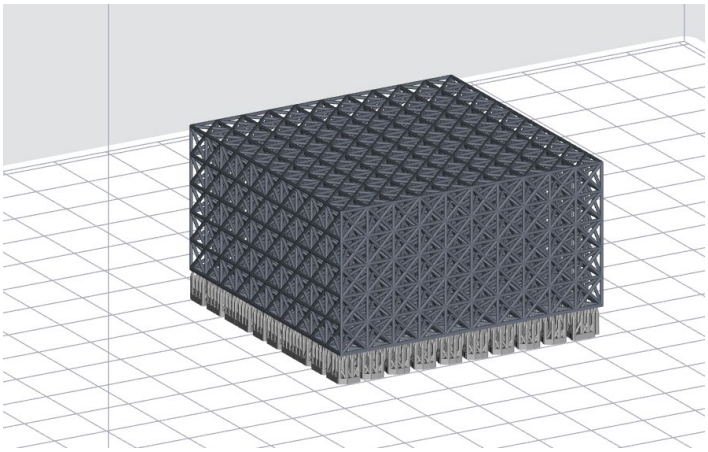

Fig. 7 Supported Part in Envision One RP Software

Print Preparation

Fill Material Vat

See Add Material Xtreme 8K. Do not overfill the material vat. Overfilling can cause the material to overflow at the start of the print job.
Ensure there are no small, cured particles in the material. If found, then the material must be filtered. See Maintain Materials Xtreme 8K.

Print Elastic ToughRubber 70

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.

See Xtreme 8K Operations & Maintenance Guide to start and complete the print.

Notice: The part removal process becomes more difficult when a part is tightly attached to the build platform. To remove the part from the build platform, place the razor scraper under one corner of the part and gently pry it.

Post-Processing

Materials Safety

The 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 SDS and contact your EHS Representative.

Clean Printed Parts

Allow the material to drip off parts for 15 minutes before cleaning. Then, immediately remove and clean parts. Always wear gloves when handling uncured material and alcohol.

See Xtreme 8K Site Prep Guide for recommended parts washing unit options. Time the end of the print to post process parts immediately. Ensure clean 99% IPA is available for part washing.

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.

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 the program is completed and the model surface is no longer glossy.
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 depending on the part geometry.
2. Remove the part(s) as soon as the program is completed and the model surface is no longer glossy.
3. Wash the part(s) in the Orbital Shaker with 99% IPA for 1 minute.
4. 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.

Dry parts with Desktop Metal's Shop System Drying Oven:

1. Pre-heat the oven to 60° C.
2. Place the parts in the oven.
3. Dry the parts for 1 hour.

Important: If parts remain dirty after cleaning with Process Option 1 and drying, repeat Step 3 and Step 4.
If parts remain dirty after cleaning with Process Option 2 and drying, repeat the washing procedure for Process Option 2 again followed by drying again. Complex parts may require 4-5 cycles of cleaning Process Option 2 plus drying until the parts are completely clean and dry.

Post Cure Printed Parts

Important: ETEC only supports ETEC's curing units.

Place parts in the curing unit with as much space between parts as possible. Parts should never touch one another while curing.
Flip parts between cycles for an even cure. Let parts cool completely before handling them or starting the next cycle.
Cure the parts using the following method:

Curing Unit	Time (H:MM:SS)	Temperature	Power
UVCA 3000	2 x 10 Minutes	20° C	100%

See Hardware Operations UVCA 3000.

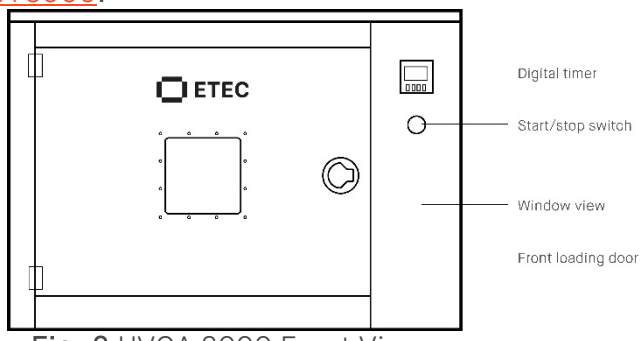

Fig. 8 UVCA 3000 Front View

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.

Anneal parts for a minimum of 10 hours to reach intended mechanical properties and to reduce odor for odor-critical applications:

1. Pre-heat Desktop Metal's Shop System Drying Oven to 120° C.
2. Place the parts in the oven.
3. Dry the parts for a minimum of 10 hours in the oven.

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