

【Phrozen Resin User Guide】

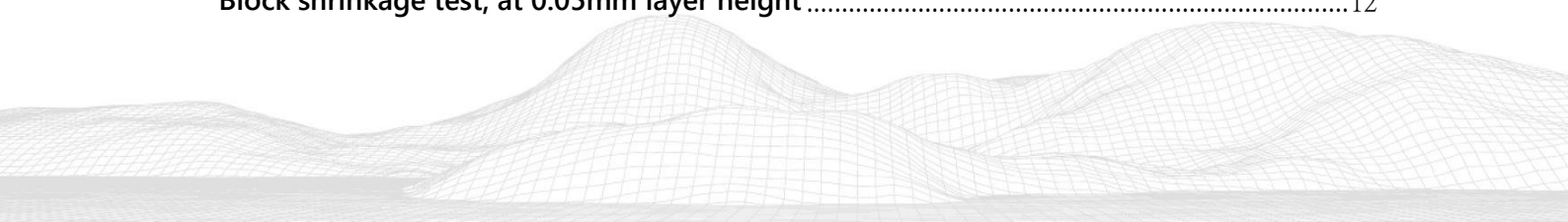
Engineering Resin: Protowhite

Outline

Before printing the perfect object, it is important to first understand the material limitations we are handling and how it can be successfully printed under various conditions. With this in mind, Phrozen provides the following design suggestions to help you better understand the properties of each material and how you can best utilize them to bring your wildest creation to life.

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Section 1

TDS

General Properties	Norm	Typical values
Appearance	-	White
Viscosity, 30	BROOKFIELD Viscometer(LV)	200 - 250 cps
Density (liquid resin)	ASTM D4052-18a	1.1 g/cm ³
Tensile Properties	Norm	Typical values (UV + thermal)
Tensile Strength at Break	ASTM D638	57 MPa
Tensile Modulus	ASTM D638	2300 MPa
Elongation at Break	ASTM D638	15 %
Flexural Properties	Norm	Typical values (UV + thermal)
Flexural Strength	ASTM D790	51.3 MPa
Flexural Modulus	ASTM D790	1431.2 MPa
Impact Properties	Norm	Typical values (UV + thermal)
Notched Izod (Machined), 23 °C	ASTM D256	28 J/m
Thermal Properties	Norm	Typical values (UV + thermal)
HDT at 0.45 MPa	ASTM D648	55 °C
Hardness	Norm	Typical values (UV + thermal)
Shore D	ASTM D2240	75 - 77 D

**** All testing specimens are printed using Phrozen Sonic Mighty 8K or Sonic Mini 8K, and post-cured using Phrozen Wash & Cure Kit.***

Specimens are printed unless stated otherwise. The information in this TDS, including product recommendations, is based on our current knowledge and experience.

Descriptions, drawings, photographs, data, proportions, weights, etc. provided may change without notice and do not establish the product's contractual quality. Request the relevant MSDS from your supplier or contact Phrozen Tech Co., Ltd at sales@phrozen3d.com

Section 2

Printing

Printing Parameters

Printer	Sonic mini / Sonic mini 4K
Layer Height	50 μm
Exposure Time	8 ± 1 s
Bottom Exposure Time	37.5 ± 2.5 s
Light-off Delay	18 s
Lift Distance	6 mm
Lifting Speed	60 mm/min

Printer	Sonic Mini 8K
Layer Height	50 μm
Exposure Time	8 ± 1 s
Bottom Exposure Time	37.5 ± 2.5 s
Light-off Delay	4 s
Lift Distance	6 mm
Lifting Speed	60 mm/min

Printer	Sonic Mini 8K S
Layer Height	50 μ m
Exposure Time	4.5 $\pm$ 0.5 s
Bottom Exposure Time	11 $\pm$ 4 s
Light-off Delay	4 s
Lift Distance	6 mm
Lifting Speed	60 mm/min

Printer	Sonic Mighty 4K
Layer Height	50 μ m
Exposure Time	8 $\pm$ 1 s
Bottom Exposure Time	37.5 $\pm$ 2.5 s
Light-off Delay	18 s
Lift Distance	8 mm
Lifting Speed	60 mm/min

Printer	Sonic Mighty 8K
Layer Height	50 μ m
Exposure Time	8 $\pm$ 1 s
Bottom Exposure Time	37.5 $\pm$ 2.5 s
Light-off Delay	4 s
Lift Distance	8 mm
Lifting Speed	60 mm/min

Printer	Sonic Mighty 12K (Upgrade Kit)
Layer Height	50 μ m
Exposure Time	9.5 $\pm$ 0.5 s
Bottom Exposure Time	37.5 $\pm$ 2.5 s
Light-off Delay	4 s
Lift Distance	8 mm
Lifting Speed	60 mm/min

Printer	Sonic Mighty Revo 14K
Layer Height	50 μ m
Exposure Time	9.5 $\pm$ 0.5 s
Bottom Exposure Time	30 $\pm$ 5 s
Light-off Delay	4 s
Lift Distance	8 mm
Lifting Speed	60 mm/min

Printer	Sonic Mighty Revo 16K (Upgrade Kit)
Layer Height	50 μ m
Exposure Time	7 $\pm$ 0.5 s
Bottom Exposure Time	20 $\pm$ 5 s
Light-off Delay	3 s
Lift Distance	8 mm
Lifting Speed	60 mm/min

Printer	Sonic Mega 8K*
Layer Height	50 μm
Exposure Time	7 $\pm$ 1 s
Bottom Exposure Time	37.5 $\pm$ 2.5 s
Light-off Delay	4 s
Lift Distance	8 mm
Lifting Speed	45 mm/min

Printer	Sonic Mega 8K S*
Layer Height	50 μm
Exposure Time	4.5 $\pm$ 0.5 s
Bottom Exposure Time	32.5 $\pm$ 2.5 s
Light-off Delay	5 s
Lift Distance	8 mm
Lifting Speed	60 mm/min

Printer	Sonic Mega 8K V2*
Layer Height	50 μm
Exposure Time	4.5 $\pm$ 0.5 s
Bottom Exposure Time	37.5 $\pm$ 2.5 s
Light-off Delay	5 s
Lift Distance	8 mm
Lifting Speed	60 mm/min

- ♦ Sonic Mega 8K / Mega 8K S / Mega 8K V2 has a higher peeling force. Therefore, a longer exposure time is necessary to increase the success rate.
- ♦ Be sure to cover the hood when printing to maintain the best printing condition of the resin.
- ♦ Increasing rest time can slow down resin accumulation, leading to improved resolution.

Cleaning

1. After removing the printed object from the building plate, use the Ultrasonic Cleaner and Phrozen Cure for post-processing.
2. Use an ultrasonic cleaner with a water bath and add 95% ethanol or IPA for cleaning for 2 minutes. (Note: A water bath is required to prevent explosion or fire.)
3. Make sure to clean the inner parts of hollow objects completely.
4. After cleaning, bake in an oven at 40 °C for 30 minutes.

*When printing flat on the building plate, remove the printed objects carefully to avoid deformation on the objects.

Post-Curing

1. Use Phrozen post-curing stations (Phrozen Wash & Cure Kit / Phrozen Cure Mega S) or other post-curing lamps with the same wavelength to cure
2. printed objects.
3. Regular UV post-curing for 120 minutes (60 minutes per side) for best results.

Section 3

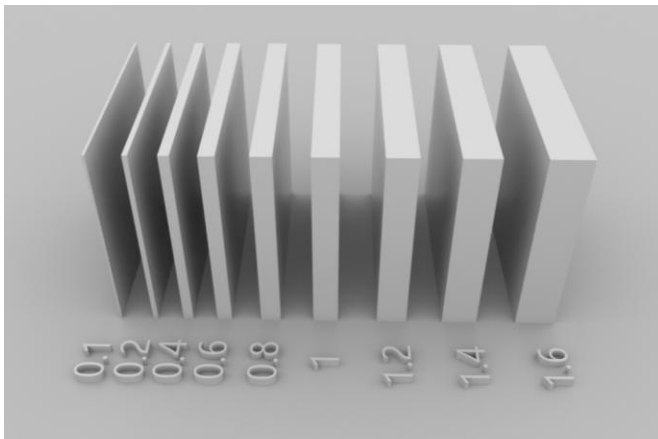
Design Specifications

※Note: All indicators are limited to each resin; the value will vary with different machines and environmental conditions.

Minimum Unsupported Wall Thickness

This indicator shows the minimum wall thickness that can be printed independently with no support without causing any bending or breaking.

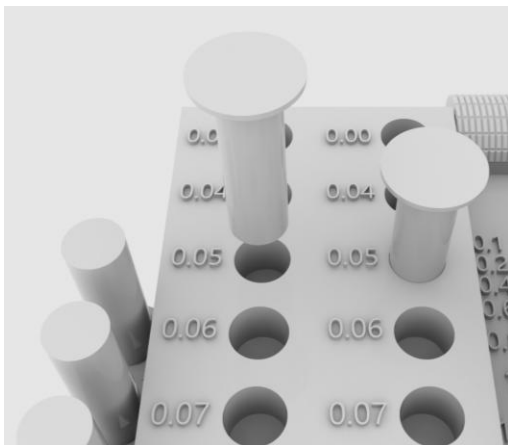
Recommended thickness : ≥ 0.4 mm



Size Tolerance, X-Y plane

This indicator shows the minimum dimensional tolerance between the hole and the column parallel to the XY plane.

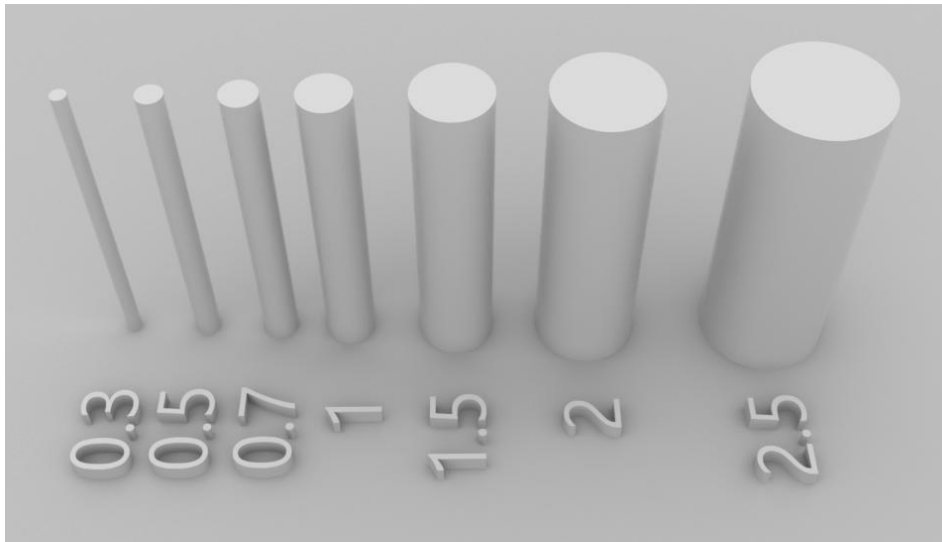
Recommended tolerance : ≥ 0.1 mm



Minimum Pin Diameter

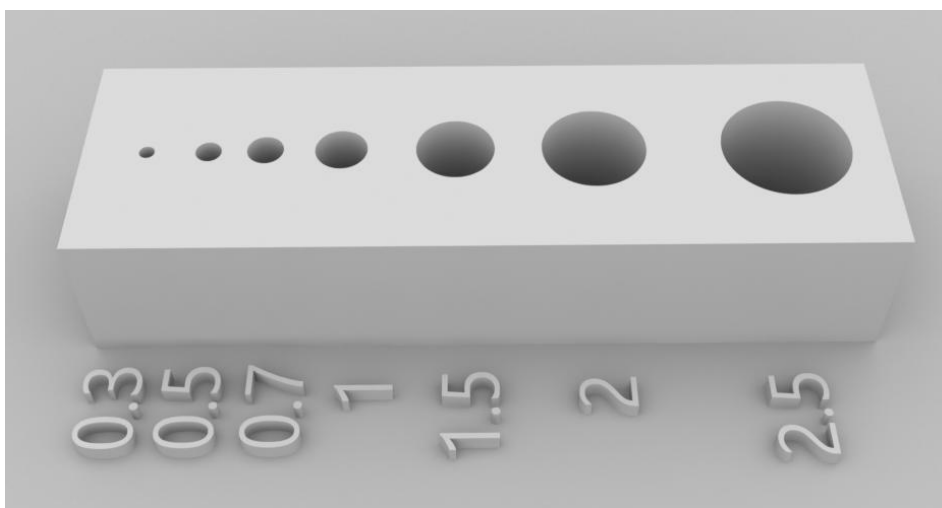
This indicator shows the minimum column diameter of pillars and supports that can be printed independently without bending or breaking.

Recommended diameter : ≥ 0.3 mm



Minimum Hole Diameter, X-Y plane

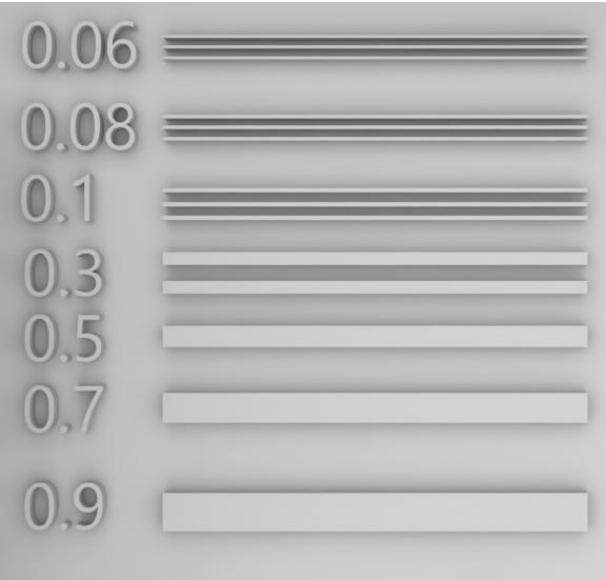
This indicator shows the minimum hole diameter that can be successfully printed parallel to the XY plane. Recommended diameter : ≥ 0.7 mm



Minimum Embossed Detail Width, X-Y plane

This indicator shows the minimum line width that can successfully be printed with embossed details.

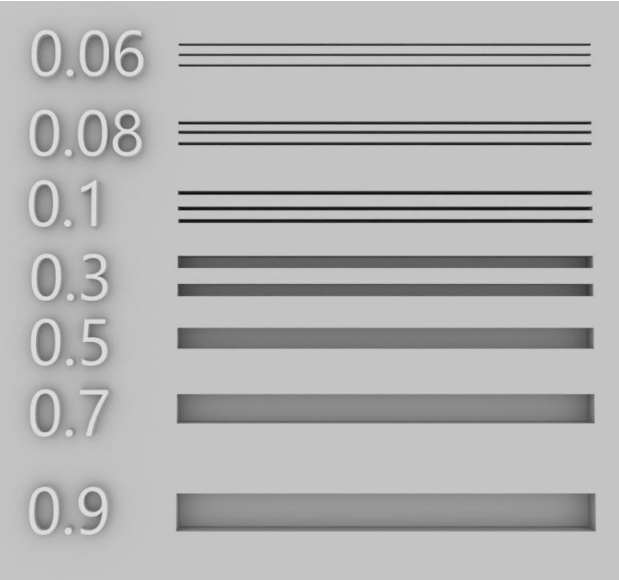
Recommended width: ≥ 0.06 mm



Minimum Engraved Detail Width, X-Y plane

This indicator shows the minimum line width that can successfully be printed with engraved details.

Recommended width: ≥ 0.1 mm



Maximum Horizontal Bridge Span

This indicator shows the maximum width between the supporting walls that can be printed without deforming the bridge.

Recommended width : $\leq 5\text{ mm}$

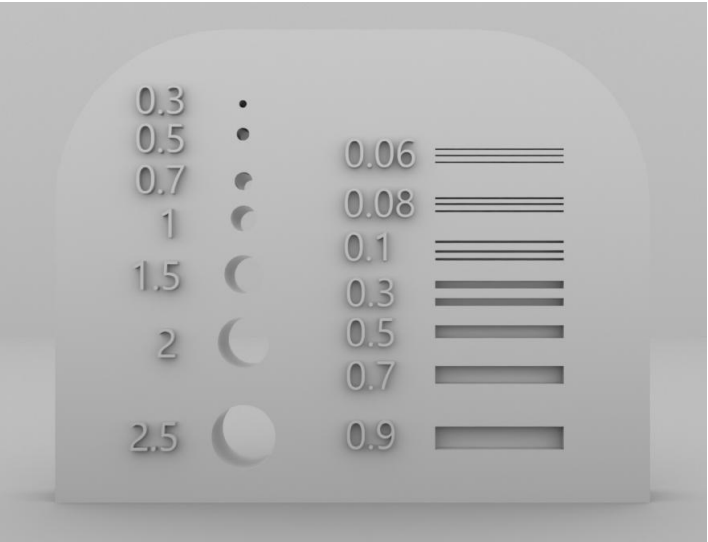


Minimum Hole Diameter and Engraved Detail Width, Z-axis, at 0.05 mm layer height

This indicator shows the minimum hole diameter and engraving groove width that can be successfully printed on the Z-axis with a layer thickness of 0.05 mm.

Recommended diameter : $\geq 0.7\text{ mm}$

Recommended width : $\geq 0.1\text{ mm}$



Block shrinkage test, at 0.05mm layer height

This indicator shows the possible deformation for a 2x2x1 cm cuboid printed parallel to the XY plane. A Vernier caliper is used to measure the cuboid after post-curing to calculate the shrinkage rate. (This test result is only for reference purposes. Different machines and models may affect results.)

Calculation method: $[(\text{Cured size} - \text{Original size}) / \text{Original size}] \times 100\%$

X-Axis Recommended Shrinkage Rate: 0.25%

Y-Axis Recommended Shrinkage Rate: 0.25%

