

【Phrozen Resin User Guide】

Engineering Resin: Ceramic Pro

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)	230 - 300 cps	
Density (liquid resin)	ASTM D4052-18a	1.65 g/cm ³	
Tensile Properties	Norm	Typical values	
		UV post-cured	UV +Thermal
Tensile Strength at Break	ASTM D638	68.4 MPa	83.8 MPa
Tensile Modulus	ASTM D638	8325.8 MPa	8380 MPa
Elongation at Break	ASTM D638	1 %	1 %
Flexural Properties	Norm	Typical values	
		UV post-cured	UV +Thermal
Flexural Strength	ASTM D790	116.2MPa	150.12 MPa
Flexural Modulus	ASTM D790	11765.9MPa	11965 MPa
Impact Properties	Norm	Typical values	
		UV post-cured	UV +Thermal
Notched Izod (Machined), 23 °C	ASTM D256	18.4 J/m	18.1 J/m

Thermal Properties	Norm	Typical values	
		UV post-cured	UV +Thermal
HDT at 0.45 MPa	ASTM D648	181.8 °C	>230 °C
Hardness	Norm	Typical values	
		UV post-cured	UV +Thermal
Shore D	ASTM D2240	>90 D	>90 D
Water Absorption	Norm	Typical values	
		UV post-cured	UV +Thermal
Short Term(24hr)	ASTM D570	0.35%	0.36%

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

** An additional thermal post-curing is required after 120 minutes of the regular UV post-curing. (Please refer to the information on the next pages for the thermal curing method and settings.)*

** Heat curing can improve mechanical properties but also increase the risk of deformation.*

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. Req

uest 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 μ m
Exposure Time	2 $\pm$ 0.5 s
Bottom Exposure Time	12 $\pm$ 5 s
Light-off Delay	13 s
Lift Distance	6 mm
Lifting Speed	60 mm/min

Printer	Sonic Mini 8K
Layer Height	50 μ m
Exposure Time	2.5 $\pm$ 0.5 s
Bottom Exposure Time	15 $\pm$ 2 s
Rest Time After Retract	4 s
Lift Distance	6 mm
Lifting Speed	60 mm/min

Printer	Sonic Mini 8K S
Layer Height	50 μ m
Exposure Time	2 $\pm$ 0.5 s
Bottom Exposure Time	13 $\pm$ 2 s
Rest Time After Retract	4 s
Lift Distance	6 mm
Lifting Speed	60 mm/min

Printer	Sonic Mighty 4K
Layer Height	50 μ m
Exposure Time	2 $\pm$ 0.5 s
Bottom Exposure Time	12 $\pm$ 5 s
Light-off Delay	14 s
Lift Distance	8 mm
Lifting Speed	60 mm/min

Printer	Sonic Mighty 8K
Layer Height	50 μ m
Exposure Time	2.5 $\pm$ 0.5 s
Bottom Exposure Time	15 $\pm$ 2 s
Rest Time After Retract	5 s
Lift Distance	8 mm
Lifting Speed	60 mm/min

Printer	Sonic Mighty 12K (Upgrade Kit)
Layer Height	50 μ m
Exposure Time	2.5 $\pm$ 0.5 s
Bottom Exposure Time	15 $\pm$ 2 s
Rest Time After Retract	5 s
Lift Distance	8 mm
Lifting Speed	60 mm/min

Printer	Sonic Mighty Revo 14K
Layer Height	50 μ m
Exposure Time	2.5 $\pm$ 0.5 s
Bottom Exposure Time	20 $\pm$ 5 s
Rest Time After Retract	5 s
Lift Distance	8 mm
Lifting Speed	60 mm/min

Printer	Sonic Mighty Revo 16K (Upgrade Kit)
Layer Height	50 μ m
Exposure Time	1.3 $\pm$ 0.5 s
Bottom Exposure Time	16 $\pm$ 5 s
Rest Time After Retract	3 s
Lift Distance	8 mm
Lifting Speed	60 mm/min

Printer	Sonic Mega 8K*
Layer Height	50 μm
Exposure Time	2.5 ± 0.5 s
Bottom Exposure Time	20 ± 5 s
Rest Time After Retract	8 ± 3 s
Lift Distance	8 mm
Lifting Speed	60 mm/min

Printer	Sonic Mega 8K S*
Layer Height	50 μm
Exposure Time	2 ± 0.5 s
Bottom Exposure Time	13 ± 3 s
Rest Time After Retract	8 ± 3 s
Lift Distance	8 mm
Lifting Speed	60 mm/min

Printer	Sonic Mega 8K V2*
Layer Height	50 μm
Exposure Time	2 ± 0.5 s
Bottom Exposure Time	20 ± 5 s
Rest Time After Retract	8 ± 3 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 Phrozen Wash and Cure Kit for post-processing.
2. Soak the object in the Washing Station filled with 99% IPA for 45–60 seconds to remove uncured resin from the surface. Do not soak models in solvent for more than 60 seconds as it may damage model surfaces. (Avoid using an ultrasonic cleaner to prevent holes on the printed part.)
3. Make sure to clean the inner parts of hollow objects completely.
4. After cleaning, Gently use an air gun to dry the printed object, and then proceed immediately to UV post-curing.

*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 printed objects.
2. The hot air circulation oven used in the Phrozen laboratory, with a temperature control accuracy of $\pm 0.1^{\circ}\text{C}$ and a uniformity of $\pm 3\%$, model: JA-72.
3. Cure the printed objects for 120 minutes (60 minutes per side) for best results. After post curing is complete, proceed immediately to thermal curing.
4. An additional thermal post-cure is recommended to enhance the mechanical properties of the materials.

	Time Setting	Temperature Setting
Ramp up phase	2 hours	30°C ~ 150 °C
Holding phase	3 hours	150 °C
Ramp down phase	2 hours	150 °C ~ 30 °C

These recommendations are intended as general advice. Please decide on the best post-curing procedure based on your specific circumstances and the equipment accessible to you.

Section 3

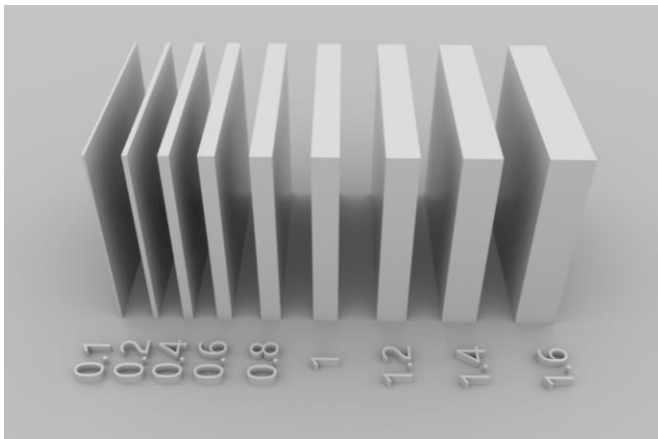
Design Specifications

※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.

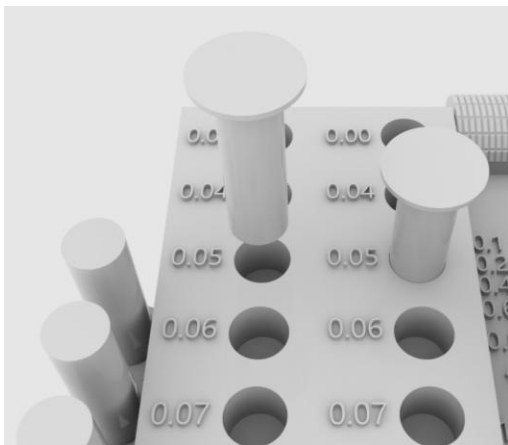
Recommended thickness : ≥ 0.2 mm



Size Tolerance, X-Y plane

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

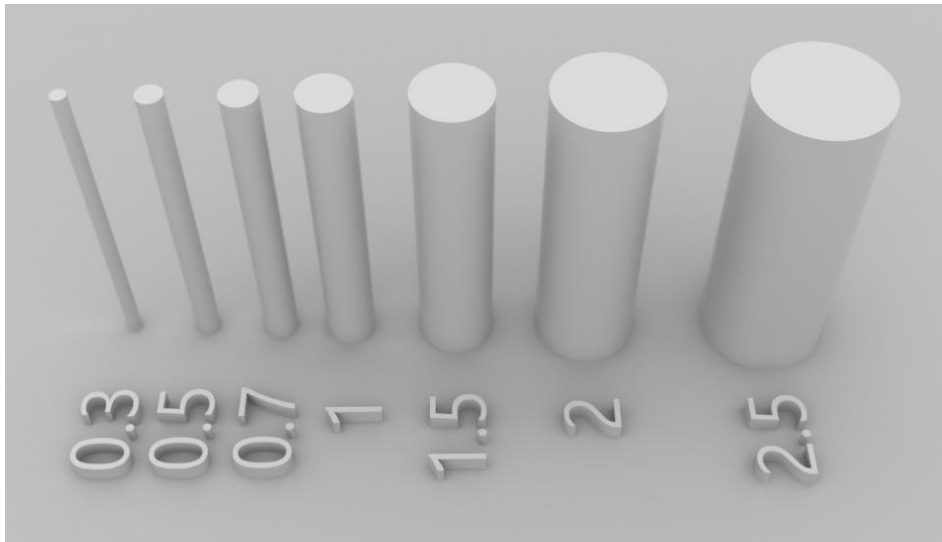
Recommended tolerance : ≥ 0.2 mm



Minimum Pin Diameter

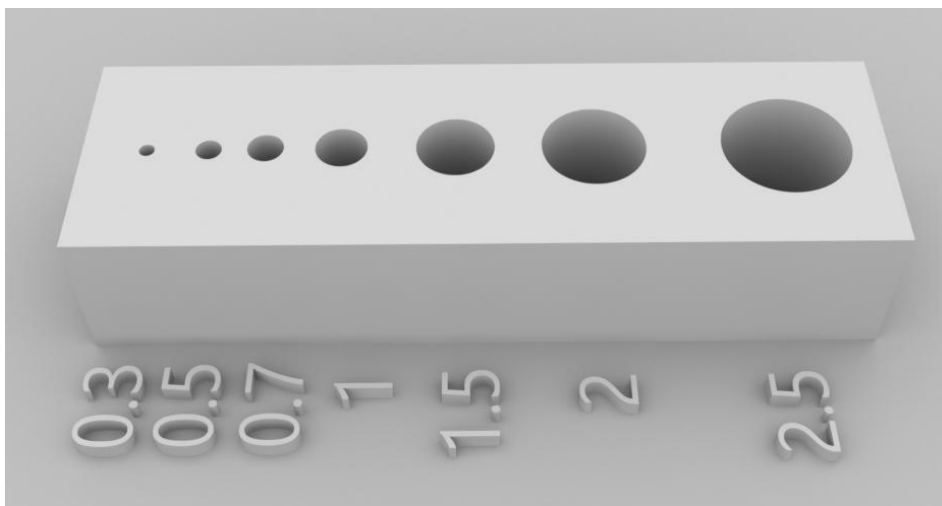
This indicator shows the minimum column diameter of pillars and supports that can be printed independently without bending or breaking.

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 : ≥ 1 mm



Minimum Embossed Detail Width, X-Y plane

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

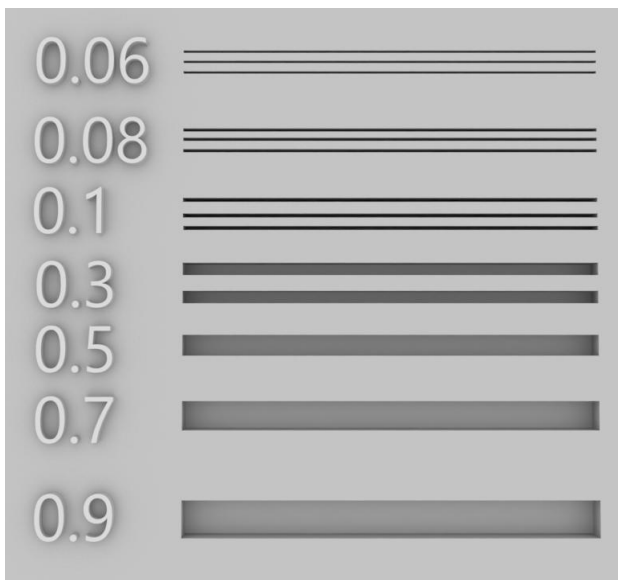
Recommended width: ≥ 0.06 mm



Minimum Engraved Detail Width, X-Y plane

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

Recommended width: ≥ 0.08 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 : ≤ 6 mm

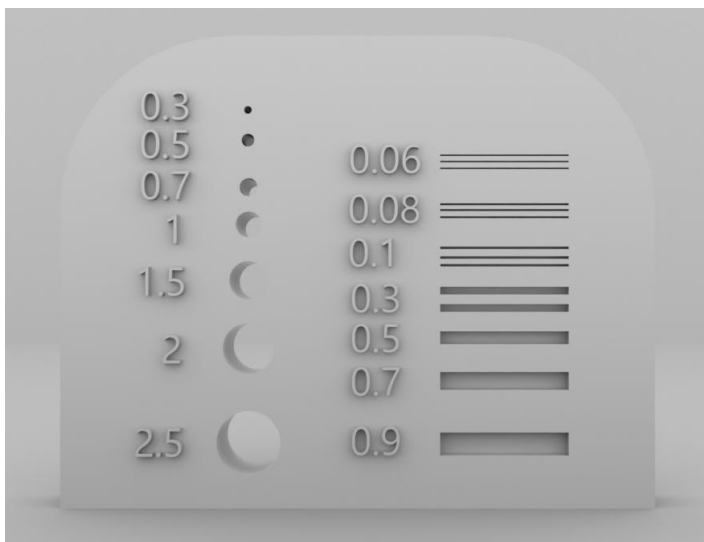


Minimum Hole Diameter and Engraved Detail Width, Z-axis, at 0.05 mm layer height

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 : ≥ 0.7 mm

Recommended width : ≥ 0.06 mm



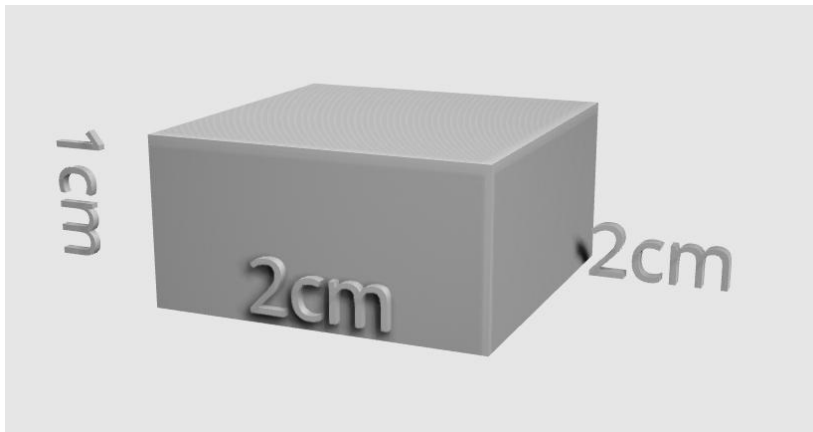
Block shrinkage test, at 0.05mm layer height

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: 0.9%

Y-Axis Recommended Shrinkage Rate: 0.95%



Section 4

Injection Molding Processing

3D Printed Mold Design

The recommended mold size is no more than 100x100 mm, and the recommended layer thickness is no more than 50um.

Draft angles of at least 2° - 3° for amorphous and 3° - 5° for semi-crystalline material on vertical walls to allow for easy demolding.

Printing

It is recommended to print the mold horizontally or vertically depending on the design. If the mold contains hollow or cavity features, printing it horizontally with supports is advised to ensure proper resin flow.

Post Processing

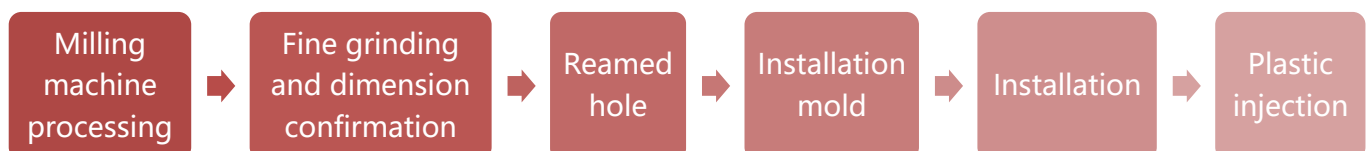


This material is very sensitive before it is fully cured. Please minimize the time intervals between printing, cleaning, UV post curing, and the final thermal curing.

Performing additional heat treatment can improve the material's heat deflection temperature and will also make the printed parts appear whiter.

For detailed procedures, please refer to page 7 above.

Mold Processing



Injection Molding

It is recommended to start with an initial fill rate of 70%. During the process, allow the mold to gradually heat up to the appropriate temperature and reach equilibrium before

applying the full load, including clamping force, locking force, and injection pressure. At the same time, be sure to avoid over-molding.

Injection Molding Process Parameters

The following data is for reference only and should be adjusted based on the material manufacturer's guidelines and the specific injection molding equipment being evaluated.

Based on	Screw diameter 30mm	PP GF30	ABS	PA6.6 GF25	POM	PC
Speeds	Circumferential speed (mm/s)	250	250	250	250	250
	Screw feed rate (cm ³ /s)	30	30	30	30	30
Paths	Switchover point to p N (cm ³)	7.0	5.5	11.3	7.3	7.7
	Dosing path (cm ³)	28	28	30	30	30
	Mass cushion (cm ³)	3.1	2.1	5.6	6.2	6.1
Times	Cycle time (s)	138	160	90	110	169
	Injection time (s)	1.06	1.12	1.2	1.1	1.1
	Post-pressure time (s)	6	7	6	6	5
	Residual cooling time (s) (In mold + air pressure cooling)	60 + 60	80 + 60	40 + 35	60 + 35	90 + 65
	Dosing time (s)	4.4	4.1	5.9	3.9	4.2
Pressures	Injection pressure (bar)	530	600	670	920	830
	Holding pressure (bar)	190	200	130	200	200
	Back pressure (bar)	60	60	60	60	60
Temperatures	Feeding zone (°C)	30	30	60	30	70
	Cylinder temperature 1 (°C)	200	210	245	170	270
	Cylinder temperature 2 (°C)	210	220	255	180	280
	Cylinder temperature 3 (°C)	220	230	265	190	290
	Nozzle temperature (°C)	220	230	290	190	290
	Temperature control unit Nozzle side (°C)	30	30	90	60	60

	Temperature control unit Ejector side (°C)	30	30	90	60	60
Forces	Clamping force (kN)	300	300	300	300	300
Drying	Drying time (h)	-	4-6	4-6	4-6	4-6
	Drying temperature (°C)	-	80	80	80	120

Injection molding demolding

It is recommended to use silicone oil or a wet-type silicone-free release agent. The release agent should be reapplied continuously during injection molding to prevent demolding failure.

- ◆ Wet-type Silicone-Free Release Agent: Reapply every 5–15 shots.
- ◆ Silicone Oil: Reapply every 15–25 shots.
- ※ Note: Silicone may transfer to the part surface. Parts must be cleaned and degreased prior to post-processing (painting, plating, etc.).

Section 5

Questions and Precautions

1. Why are there cracks on the printed part surface after curing?

This may be due to insufficient exposure or using a different cleaning solvent such as alcohol. Increase the exposure time and use IPA for cleaning. Also, minimize the interval between each processing step to improve the issue.

2. Why does the printed part show color differences before curing, after curing, and after thermal curing?

This is related to the ceramic material. The structural arrangement before and after UV curing affects how light is reflected, resulting in different perceived colors. After thermal curing, the structure becomes denser and more compact, which again changes surface light reflection. Normally, the object will appear whiter after thermal curing.

3. This material is more sensitive to ambient light. Please minimize exposure to ambient light and always cover the printer with a light-blocking shield during printing.

4. This material contains a high ceramic content. If powder appears on the printed part, it is recommended to perform additional thermal curing after UV post-curing. If powder still remains, you may clean the surface with distilled water to resolve it.

(Note: The printed part must be dried immediately after cleaning.)