

【Phrozen Resin User Guide】

Engineering Resin: FR940, Gray

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	-	Gray	
Viscosity, 30	BROOKFIELD Viscometer(LV)	180 - 285 cps	
Density (liquid resin)	ASTM D4052-18a	1.14 g/cm ³	
Tensile Properties	Norm	Typical values	
		UV post-cured	UV +Thermal
Tensile Strength at Break	ASTM D638	28.5 MPa	38.1 MPa
Tensile Modulus	ASTM D638	1812 MPa	1537 MPa
Elongation at Break	ASTM D638	3.8 %	4.9 %
Flexural Properties	Norm	Typical values	
		UV post-cured	UV +Thermal
Flexural Strength	ASTM D790	38.5 MPa	50.7 MPa
Flexural Modulus	ASTM D790	1557.4 MPa	1553.8 MPa
Impact Properties	Norm	Typical values	
		UV post-cured	UV post-cured
Notched Izod (Machined), 23 °C	ASTM D256	30.7 J/m	17.5J/m

Thermal Properties	Norm	Typical values	
		UV post-cured	UV post-cured
HDT at 0.45 MPa	ASTM D648	59.8 °C	82.8 °C
Hardness	Norm	Typical values	
		UV post-cured	UV post-cured
Shore D	ASTM D2240	75 - 80D	80 - 82D
Flammability	Norm	Typical values	
V-0 Burning stops within 10 seconds on a vertical specimen; drips of particles are allowed as long as they are not inflamed.	UL94 V-0	3.0-3.3mm 	

** 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

UL Blue Card Certification

iq.ul.com

Plastics for Additive Manufacturing

Guide Information

[View Certificate of Compliance](#)

E535425

PHROZEN TECH CO LTD

3rd Fl 287 Niupu Rd Zhongpu Vlg Xiangshan District, Hsinchu 300059 TW

Phrozen-FR940 (#)

Process Category: VAT Polymerization - Liquid Crystal Display (LCD)
Acrylic, furnished as Liquid

Color	Min. Thk (mm)	Flame Class	HWI	HAI	RTI Elec	RTI Imp	RTI Str
GY	3.0-3.3	V-0	-	-	50	50	50

Comparative Tracking Index (CTI): -	Inclined Plane Tracking (IPT) kV: -
Dielectric Strength (kV/mm): -	Volume Resistivity (10 ^x ohm-cm): -
High-Voltage Arc Tracking Rate (HVTR): -	Surface Resistivity (10 ^x ohms/square): -
Dimensional Change (%): -	High Volt, Low Current Arc Resis (D495): -

Processing Parameters

Build Plane: Horizontal & Vertical

Layer Thickness (mm): 0.05-0.1

Post Processing Method: Please see footnote (#)

For use with printer: Phrozen Sonic Mini 4K

Limited properties and ratings assigned to samples produced by the Additive Manufacturing technique representing a specific set of printing parameters and build strategy.
Other print parameters and build strategies may result in significantly different results.

(#) - Soak object in Phrozen Wash with 95% alcohol for 45-60 seconds. Remove to well-ventilated area for min 30 minutes or gently use compressed air to dry the object with no exposure to light. Use post-curing equipment (Phrozen Cure & Wash/Phrozen Cure/ Phrozen Mega Cure) or other post-curing lamps with the same wavelength to cure for 30 minutes.

IEC/ISO small-scale test data does not pertain to building materials, furnishings and related contents. IEC/ISO small-scale test data is intended solely for determining the flammability of plastic materials used in the components and parts of end-product devices and appliances, where the acceptability of the combination is determined by UL.

Report Date: 2023-09-21

Last Revised: 2023-11-01

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IEC and ISO Test Methods

Test Name	Test Method	Units	Thk (mm)	Value
Flammability	IEC 60695-11-10	Class (color)	3.0-3.3	V-0 (GY)
Glow-Wire Flammability (GWFI)	IEC 60695-2-12	°C	-	-
Glow-Wire Ignition (GWIT)	IEC 60695-2-13	°C	-	-
IEC Comparative Tracking Index	IEC 60112	Volts (Max)	-	-
IEC AC Dielectric Strength (AC DS)	IEC 60243-1	kV/mm	-	-
IEC DC Dielectric Strength (DC DS)	IEC 60243-2	kV/mm	-	-
IEC Volume Resistivity (VR)	IEC 62631-3-1	10 ^x ohm-m	-	-
IEC Surface Resistivity (SR)	IEC 62631-3-2	10 ^x ohms	-	-
IEC Inclined Plane Tracking (IPT)	IEC 60587	kV	-	-
IEC Ball Pressure	IEC 60695-10-2	°C	-	-
ISO Heat Deflection (1.80 MPa)	ISO 75-2	°C	-	-
ISO Tensile Strength	ISO 527-2	MPa	-	-
ISO Flexural Strength	ISO 178	MPa	-	-
ISO Tensile Impact	ISO 8256	kJ/m ²	-	-
ISO Izod Impact	ISO 180	kJ/m ²	-	-
ISO Charpy Impact	ISO 179-1	kJ/m ²	-	-

Section 3

Printing

Printing Parameters

Printer	Sonic mini / Sonic mini 4K
Layer Height	50 μm
Exposure Time	4 ± 0.5 s
Bottom Exposure Time	30 ± 5 s
Light-off Delay	15 s
Lift Distance	6 mm
Lifting Speed	60 mm/min

Printer	Sonic Mini 8K
Layer Height	50 μm
Exposure Time	2.8 ± 0.3 s
Bottom Exposure Time	35 ± 5 s
Light-off Delay	3 s
Lift Distance	6 mm
Lifting Speed	60 mm/min

Printer	Sonic Mini 8K S
Layer Height	50 μ m
Exposure Time	1.8 $\pm$ 0.3 s
Bottom Exposure Time	12.5 $\pm$ 2.5 s
Light-off Delay	3 s
Lift Distance	6 mm
Lifting Speed	60 mm/min

Printer	Sonic Mighty 4K
Layer Height	50 μ m
Exposure Time	2.8 $\pm$ 0.3 s
Bottom Exposure Time	35 $\pm$ 5 s
Light-off Delay	12 s
Lift Distance	8 mm
Lifting Speed	60 mm/min

Printer	Sonic Mighty 8K
Layer Height	50 μ m
Exposure Time	2.8 $\pm$ 0.3 s
Bottom Exposure Time	35 $\pm$ 5 s
Light-off Delay	3 s
Lift Distance	8 mm
Lifting Speed	60 mm/min

Printer	Sonic Mighty 12K (Upgrade Kit)
Layer Height	50 μm
Exposure Time	$2.7 \pm 0.3 \text{ s}$
Bottom Exposure Time	$35 \pm 5 \text{ s}$
Light-off Delay	3 s
Lift Distance	8 mm
Lifting Speed	60 mm/min

Printer	Sonic Mighty Revo 14K
Layer Height	50 μm
Exposure Time	$2.7 \pm 0.3 \text{ s}$
Bottom Exposure Time	$35 \pm 5 \text{ s}$
Light-off Delay	3 s
Lift Distance	8 mm
Lifting Speed	60 mm/min

Printer	Sonic Mighty Revo 16K (Upgrade Kit)
Layer Height	50 μm
Exposure Time	$1.8 \pm 0.5 \text{ s}$
Bottom Exposure Time	$20 \pm 5 \text{ s}$
Light-off Delay	3 s
Lift Distance	8 mm
Lifting Speed	60 mm/min

Printer	Sonic Mega 8K*
Layer Height	50 μ m
Exposure Time	3 $\pm$ 0.5 s
Bottom Exposure Time	35 $\pm$ 5 s
Light-off Delay	3 s
Lift Distance	8 mm
Lifting Speed	45 mm/min

Printer	Sonic Mega 8K S*
Layer Height	50 μ m
Exposure Time	1.8 $\pm$ 0.2 s
Bottom Exposure Time	17.5 $\pm$ 2.5 s
Light-off Delay	3 s
Lift Distance	8 mm
Lifting Speed	60 mm/min

Printer	Sonic Mega 8K V2*
Layer Height	50 μ m
Exposure Time	1.7 $\pm$ 0.3 s
Bottom Exposure Time	22.5 $\pm$ 2.5 s
Light-off Delay	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 water or 95% ethanol 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. (When washing with water, it is recommended to use ethanol for a final quick rinse to clean the object's surface.)
3. Make sure to clean the inner parts of hollow objects completely.
4. After thoroughly cleaning the object, leave it in a cool, well-ventilated place for at least 30 minutes. Alternatively, you may gently use a compressed air gun to dry the printed object.

*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. Regular UV post-curing for 60 minutes and additional thermal post-cure of 2 h at 80°C.

Section 4

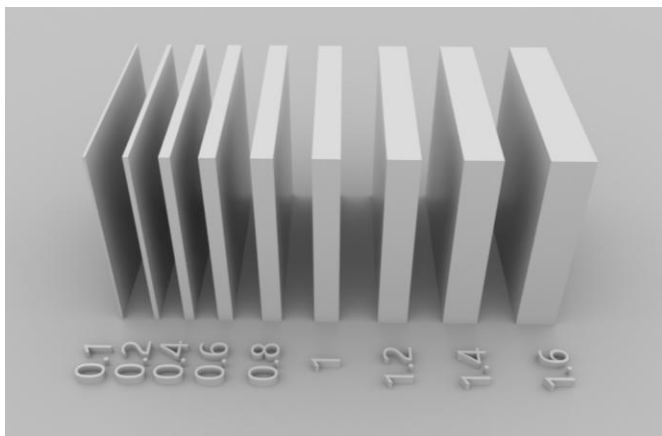
Design Specifications

※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.

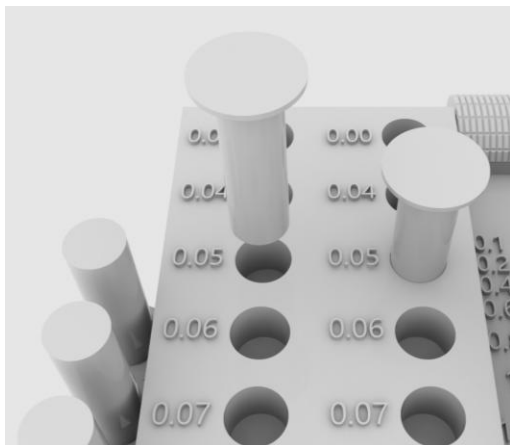
Recommended thickness : ≥ 0.4 mm



Size Tolerance, X-Y plane

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

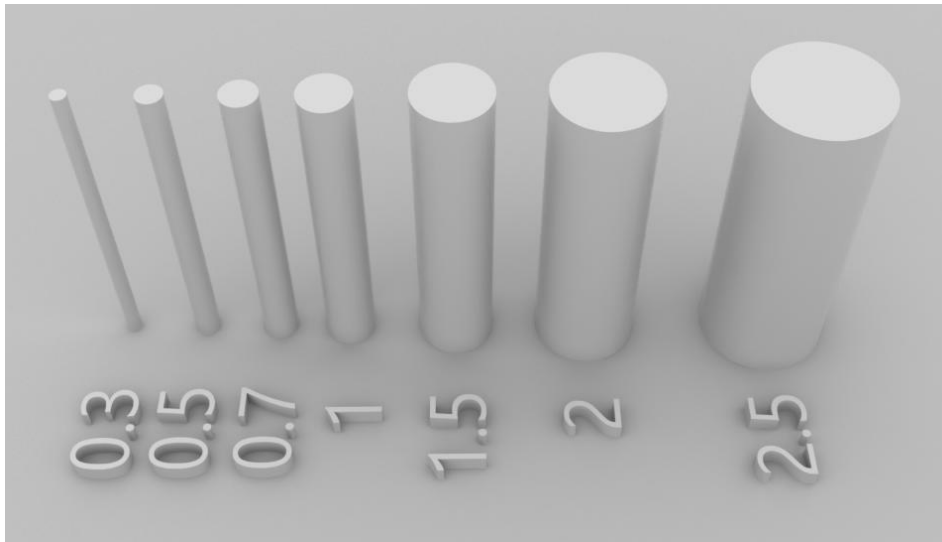
Recommended tolerance : ≥ 0.2 mm



Minimum Pin Diameter

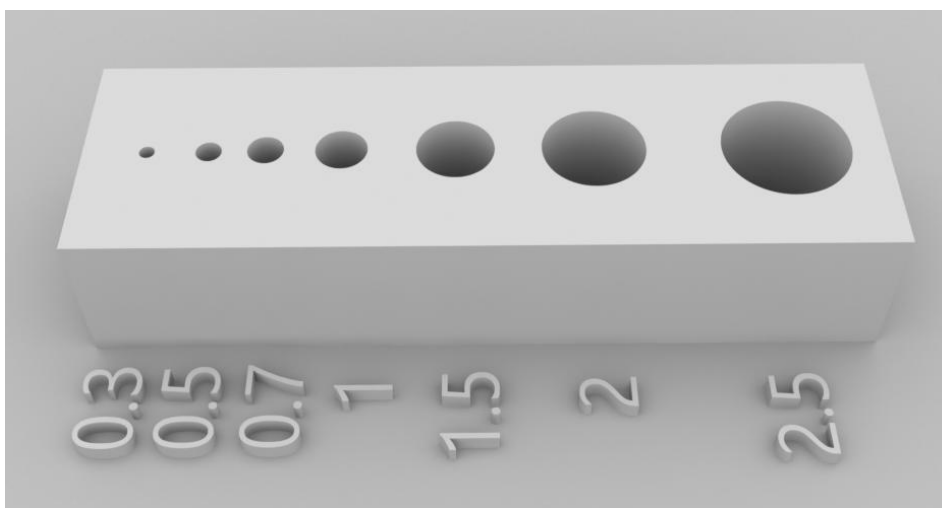
This indicator shows the minimum column diameter of pillars and supports that can be printed independently without bending or breaking.

Recommended diameter : ≥ 0.7 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.

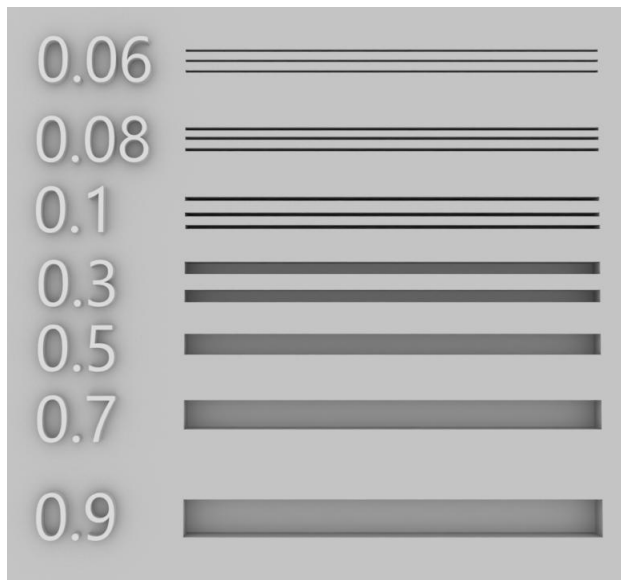
Recommended width: ≥ 0.1 mm



Minimum Engraved Detail Width, X-Y plane

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

Recommended width: ≥ 0.5 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

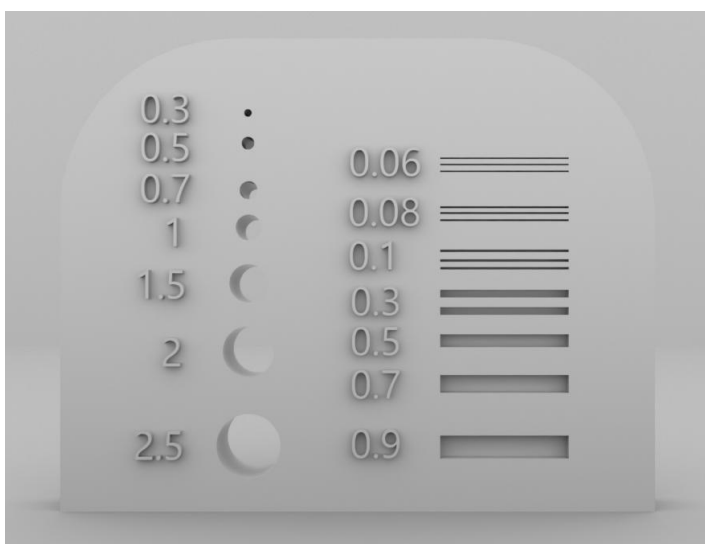


Minimum Hole Diameter and Engraved Detail Width, Z-axis, at 0.05mm layer height

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 : ≥ 0.3 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: 0.2%

Y-Axis Recommended Shrinkage Rate: 0.05%

