

【Phrozen Resin User Guide】

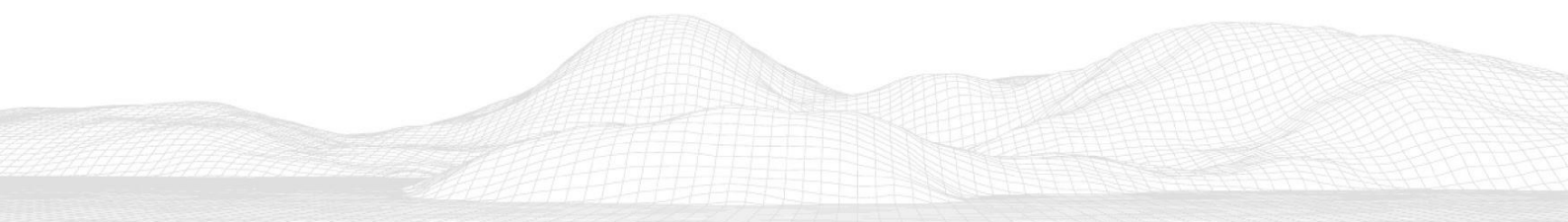
Engineering Rigid Resin: PC/GF-like, Black

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	-	Black	
Viscosity, 30	BROOKFIELD Viscometer(LV)	220 - 300 cps	
Density (liquid resin)	ASTM D4052-18a	1.12 g/cm ³	
Tensile Properties	Norm	Typical values	
		UV post-cured	UV +Thermal
Tensile Strength at Break	ASTM D638	48.4 MPa	63 MPa
Tensile Modulus	ASTM D638	2567 MPa	3330MPa
Elongation at Break	ASTM D638	9.4 %	5.5 %
Flexural Properties	Norm	Typical values	
		UV post-cured	UV +Thermal
Flexural Strength	ASTM D790	110.8 MPa	114.4 MPa
Flexural Modulus	ASTM D790	3015.9 MPa	3007.5 MPa
Impact Properties	Norm	Typical values	
		UV post-cured	UV post-cured
Notched Izod (Machined), 23 °C	ASTM D256	39.8 J/m	35.5 J/m
Thermal Properties	Norm	Typical values	
		UV post-cured	UV post-cured
HDT at 0.45 MPa	ASTM D648	65 °C	95.6 °C

Hardness	Norm	Typical values	
		UV post-cured	UV post-cured
Shore D	ASTM D2240	80 - 82D	80 - 85D

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

** Regular UV post-curing for 120 minutes and additional thermal post-cure of 2h at 100°C*

** Increasing curing time can improve mechanical properties, but also increase the risk of deformati*

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

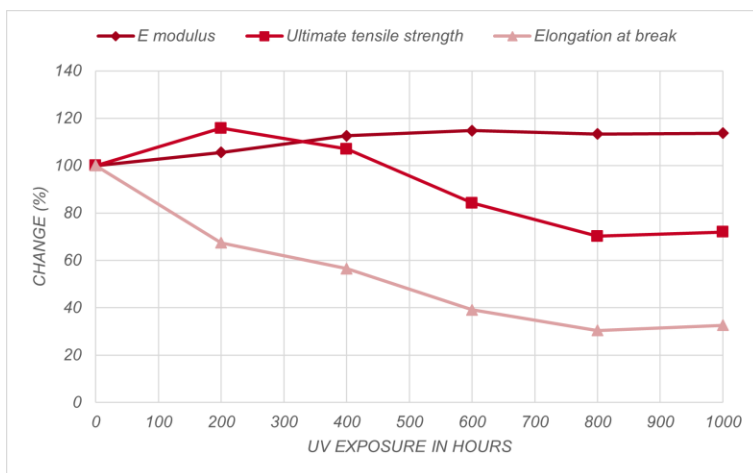
Long-Term Exposure Test

Durability is a desired key feature for the components utilized within many industries, as they expect the materials used to withstand years of exposure to the elements. However, through the effects of UV radiation, variation in temperatures, and exposure to moisture, photopolymers can degrade over time. The degree of degradation highly depends on the duration and intensity of the continued exposure.

Test Method and Specimens

The aging tests were performed with ASTM D638 type IV tensile bars as per ISO 4892-2:2013 method A, cycle 1.

Mechanical Testing



Change in mechanical properties after accelerated weathering.

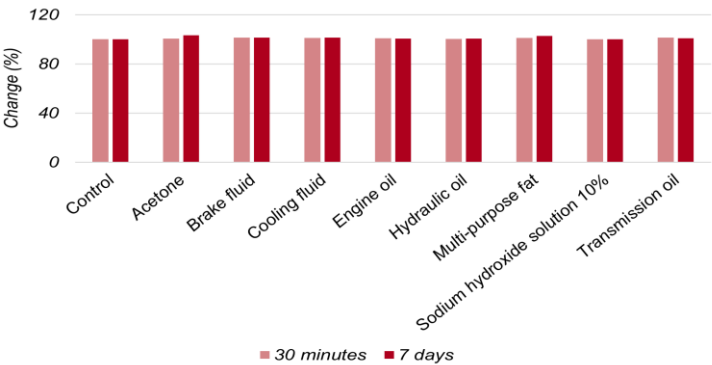
Section 3

Resistance to Industrial Chemical Substances

Test Method and Specimens

ASTM D638 type IV tensile bars were soaked in each fluid at room temperature, one set for 30 minutes and one set for 7 days. Upon completion of the soaking time, the parts were removed from the test fluid and were dried to measure the weight and the mechanical properties.

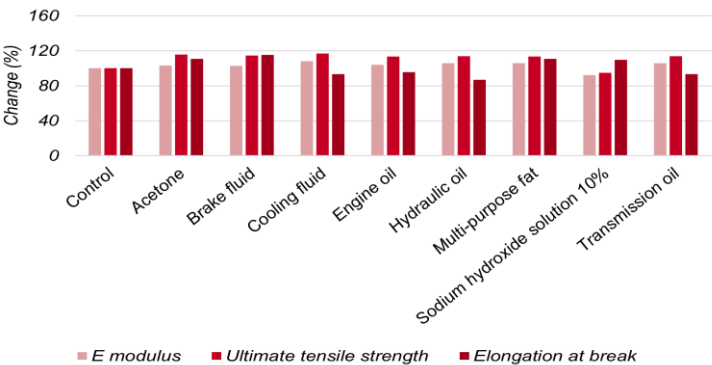
Weight Measurement



Change in weight in regards to immersion time

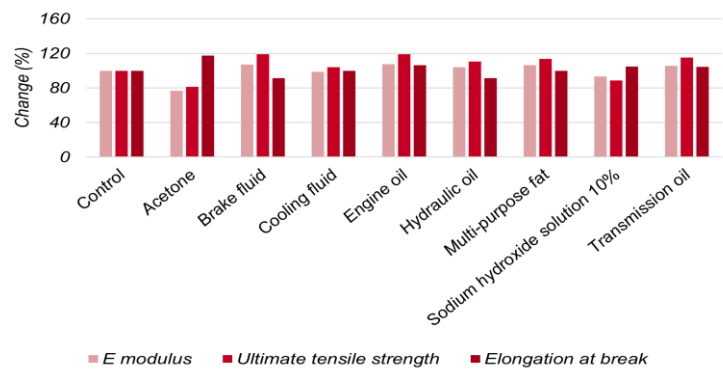
Mechanical Testing

30 minutes



Change in mechanical properties after 30 minutes of immersion.

7 days



Change in mechanical properties after 7 days of immersion.

Section 4

Thermal Shock Test & Freezing Test

Test Method and Specimens

ASTM D 638 Type IV specimen with following conditions, conduct the test immediately after the cycle is accomplished. The test will reveal the changes in mechanical properties under extreme environmental conditions.

Thermal Shock Test:

Low Temperature:-40°C,0.5hour

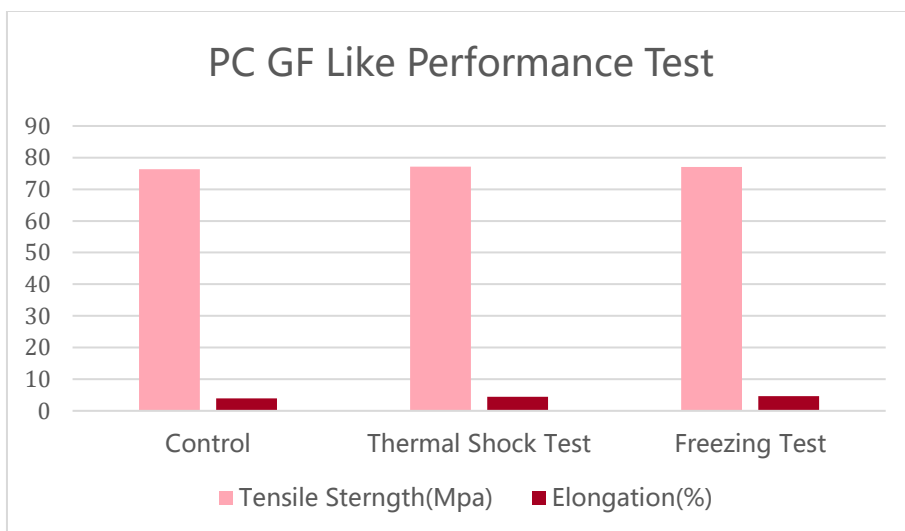
High Temperature:85°C,0.5hour

Temperature Transition Time:5minutes

Total Cycles: 10 Cycles

Freezing Test:

Low Temperature: -40°C,96hour



Section 5

Printing

Printing Parameters

Printer	Sonic mini / Sonic mini 4K
Layer Height	50 μm
Exposure Time	17.5 ± 2.5 s
Bottom Exposure Time	12.5 ± 2.5 s
Light-off Delay	11 s
Lift Distance	6 mm
Lifting Speed	60 mm/min

Printer	Sonic Mini 8K
Layer Height	50 μm
Exposure Time	17.5 ± 2.5 s
Bottom Exposure Time	12.5 ± 2.5 s
Light-off Delay	2 s
Lift Distance	6 mm
Lifting Speed	60 mm/min

Printer	Sonic Mini 8K S
Layer Height	50 μ m
Exposure Time	12.5 $\pm$ 2.5 s
Bottom Exposure Time	8 $\pm$ 2 s
Light-off Delay	2 s
Lift Distance	6 mm
Lifting Speed	60 mm/min

Printer	Sonic Mighty 4K
Layer Height	50 μ m
Exposure Time	17.5 $\pm$ 2.5 s
Bottom Exposure Time	12.5 $\pm$ 2.5 s
Light-off Delay	11 s
Lift Distance	8 mm
Lifting Speed	60 mm/min

Printer	Sonic Mighty 8K
Layer Height	50 μ m
Exposure Time	17.5 $\pm$ 2.5 s
Bottom Exposure Time	12.5 $\pm$ 2.5 s
Light-off Delay	2 s
Lift Distance	8 mm
Lifting Speed	60 mm/min

Printer	Sonic Mighty 12K (Upgrade Kit)
Layer Height	50 μ m
Exposure Time	17.5 $\pm$ 2.5 s
Bottom Exposure Time	12.5 $\pm$ 2.5 s
Light-off Delay	2 s
Lift Distance	8 mm
Lifting Speed	60 mm/min

Printer	Sonic Mighty Rev0 14K
Layer Height	50 μ m
Exposure Time	13.5 $\pm$ 0.5 s
Bottom Exposure Time	18 $\pm$ 5 s
Light-off Delay	4 s
Lift Distance	8 mm
Lifting Speed	60 mm/min

Printer	Sonic Mighty Rev0 16K (Upgrade Kit)
Layer Height	50 μ m
Exposure Time	10 $\pm$ 0.5 s
Bottom Exposure Time	12 $\pm$ 5 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	22.5 $\pm$ 2.5 s
Bottom Exposure Time	15 $\pm$ 5 s
Light-off Delay	2 s
Lift Distance	8 mm
Lifting Speed	45 mm/min

Printer	Sonic Mega 8K S*
Layer Height	50 μ m
Exposure Time	20.5 $\pm$ 2.5 s
Bottom Exposure Time	12.5 $\pm$ 2.5 s
Light-off Delay	2 s
Lift Distance	8 mm
Lifting Speed	60 mm/min

Printer	Sonic Mega 8K V2*
Layer Height	50 μ m
Exposure Time	20.5 $\pm$ 2.5 s
Bottom Exposure Time	15 $\pm$ 5 s
Light-off Delay	2 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 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. Make sure to clean the inner parts of hollow objects completely.
3. 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 120 minutes and additional thermal post-cure of 2h at 100°C.

Section 6

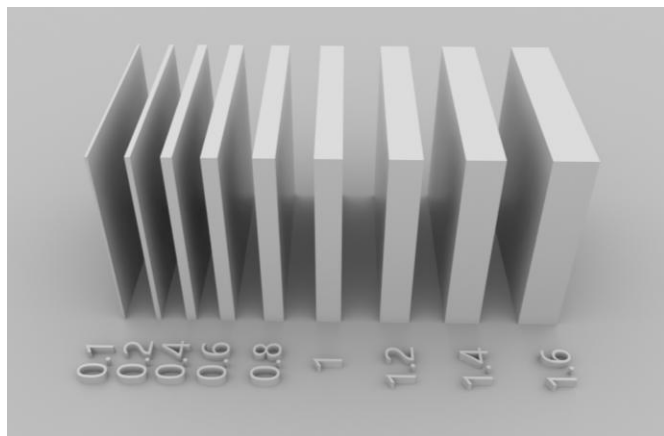
Design Specifications

※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.

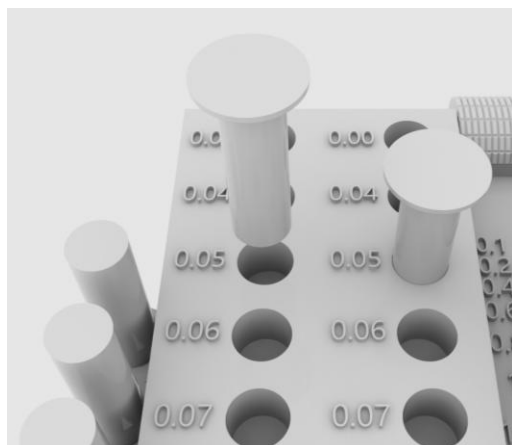
Recommended thickness : ≥ 0.2 mm



Size Tolerance, X-Y plane

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

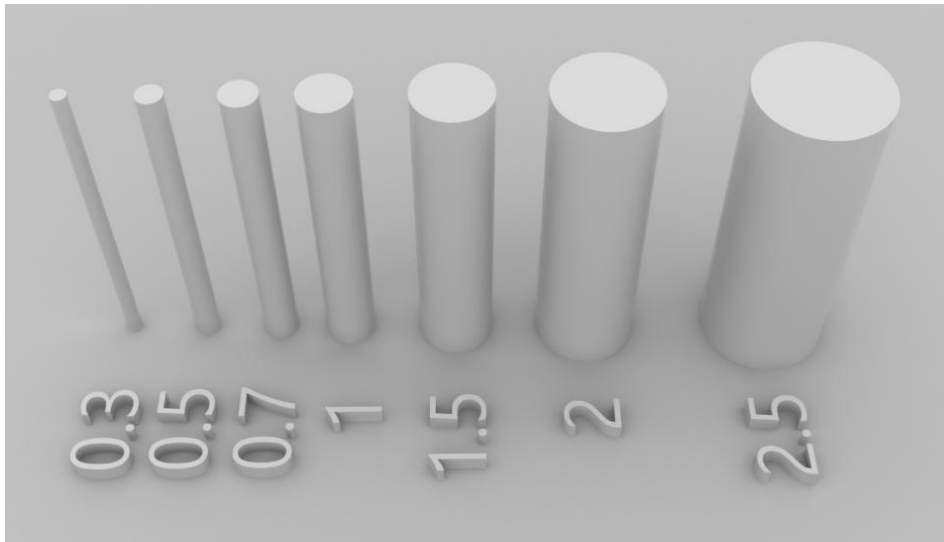
Recommended tolerance : ≥ 0.04 mm



Minimum Pin Diameter

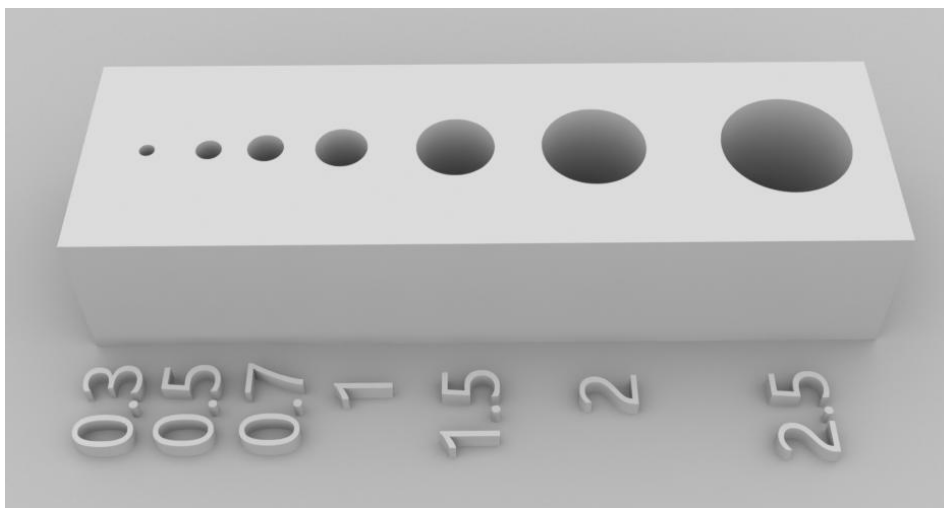
This indicator shows the minimum column diameter of pillars and supports that can be printed independently without bending or breaking.

Recommended diameter : ≥ 0.5 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 : ≥ 0.3 mm



Minimum Embossed Detail Width, X-Y plane

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

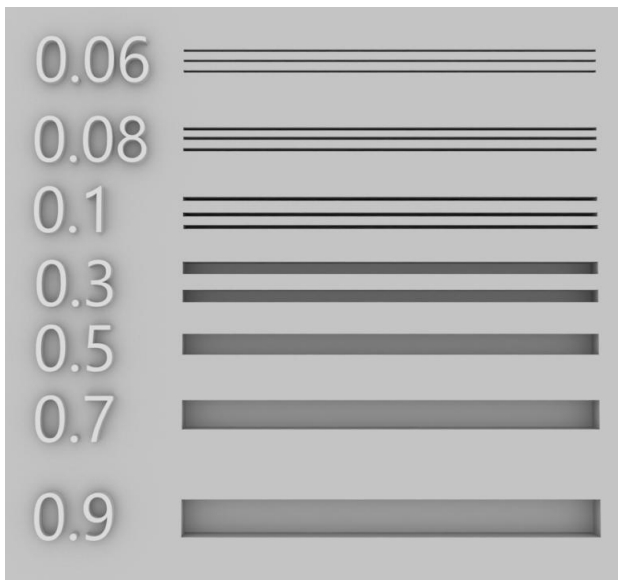
Recommended width: ≥ 0.1 mm



Minimum Engraved Detail Width, X-Y plane

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

Recommended width: ≥ 0.08 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

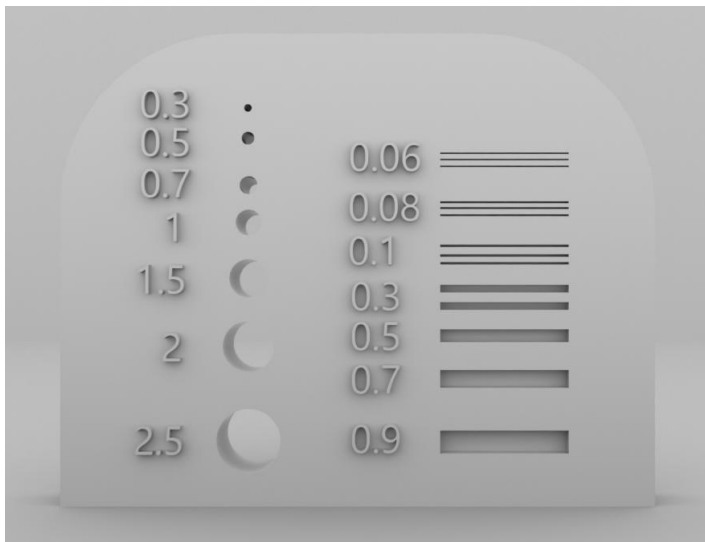


Minimum Hole Diameter and Engraved Detail Width, Z-axis, at 0.05 mm layer height

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: -0.2%

Y-Axis Recommended Shrinkage Rate: 0.15%

