

SLA

Stereolithography



Clear Resin V5

An optimally-balanced Clear Resin for transparent applications

Clear Resin V5 is an exceptionally clear and color-neutral General Purpose Resin, offering an optimal balance of fast print speed, high dimensional accuracy, and presentation-ready appearance.

Clear Resin V5 creates highly transparent and colorless parts that can be polished to near optical transparency. Create parts that are stiff and strong with a smooth surface finish that rivals acrylic.

Clear Resin V5 is a new material formulation that leverages the Form 4 ecosystem to print three times faster than the previous version.

Transparent enclosures, optical components, and lighting prototypes

Molds, masters, and other rapid tooling

Parts showcasing internal features

Fluidic devices



FLGPCL05

Prepared 20/03/2024

Rev. 01 20/03/2024

To the best of our knowledge the information contained herein is accurate. However, Formlabs, Inc. makes no warranty, expressed or implied, regarding the accuracy of these results to be obtained from the use thereof.

Material Properties	METRIC ¹			IMPERIAL ¹			METHOD
	Green	Post-Cured for 5 min at ambient for 15 min temperature ²	Post-Cured at 60 °C ³	Green	Post-Cured for 5 min at ambient for 15 min temperature ²	Post-Cured at 140 °F ³	
Tensile Properties	METRIC ¹			IMPERIAL ¹			METHOD
Ultimate Tensile Strength	46 MPa	51 MPa	60 MPa	6672 psi	7340 psi	8702 psi	ASTM D638-14
Tensile Modulus	2200 MPa	2575 MPa	2750 MPa	319 ksi	373 ksi	399 ksi	ASTM D638-14
Elongation at Break	13%	10%	8%	13%	10%	8%	ASTM D638-14
Flexural Properties	METRIC ¹			IMPERIAL ¹			METHOD
Flexural Strength Flexural	82 MPa	91 MPa	103 MPa	11893 psi	13198 psi	14938 psi	ASTM D790-15
Modulus	2000 MPa	2450 MPa	2750 MPa	290 ksi	355 ksi	399 ksi	ASTM D790-15
Impact Properties	METRIC ¹			IMPERIAL ¹			METHOD
Notched Izod	31 J/m	29 J/m		0.580 ft-lb/in	0.542 ft-lb/in		ASTM D4812-11
Thermal Properties	METRIC ¹			IMPERIAL ¹			METHOD
Heat Deflection Temp. @ 1.8 MPa	54 °C	57 °C		129 °F	135 °F		ASTM D648-16
Heat Deflection Temp. @ 0.45 MPa	61 °C	69 °C		142 °F	156 °F		ASTM D648-16

Polished Optical Properties	Post-Cured for 5 min at ambient temperature ²		Post-Cured for 15 min at 60 °C ³	
	Transmission @ 2 mm	85%	85%	ASTM D1003-21
a* @ 2 mm		-4.02	-4.31	ASTM E1348-15
b* @ 2 mm		7.52	5.58	ASTM E1348-15
Transmission @ 10 mm		59%	59%	ASTM D1003-21
a* @ 10 mm		-4.25	-3.98	ASTM E1348-15
b* @ 10 mm		5.98	5.94	ASTM E1348-15

Transmission refers to the amount of visible light that passes through the part

a* and b* are more commonly associated with the CIE LAB color space, where they denote axes for color measurement:
a* axis: Ranges from green to red, with negative values indicating green and positive values indicating red.
b* axis: Ranges from blue to yellow, with negative values indicating blue and positive values indicating yellow.

SOLVENT COMPATIBILITY

Percent weight gain over 24 hours for a printed and post-cured 1 x 1 x 1 cm cube immersed in respective solvent:

Solvent	24 hr weight gain, %	Solvent	24 hr weight gain, %	Solvent	24 hr weight gain, %
Acetic Acid 5%	0.9	Hydrogen peroxide (3%)	0.9	Sodium Hydroxide solution (0.025% PH 10)	0.8
Acetone	5.1	Isooctane (aka gasoline)	< 0.1	Strong Acid (HCl conc)	0.5
Bleach ~5% NaOCl	0.7	Isopropyl Alcohol	0.3	Tripropylene glycol monomethyl ether	0.5
Butyl Acetate	0.3	Mineral oil (Heavy)	0.2	Water	0.9
Diesel Fuel	0.1	Mineral oil (Light)	0.2	Xylene	< 0.1
Diethyl glycol	0.1	Salt Water (3.5% NaCl)	0.8		
Monomethyl Ether	1.1	Skydrol 5	0.7		
Hydraulic Oil	0.1				

¹ Material properties may vary based on part geometry, print orientation, print settings, temperature, and disinfection or sterilization methods used.

² Data was obtained from parts printed on a Form 4 printer with 100 µm Clear Resin VS settings, washed in a Form Wash for 5 minutes in >99% Isopropyl Alcohol, and post-cured at room temperature for 5 minutes in a Form Cure.

³ Data was obtained from parts printed on a Form 4 printer with 100 µm Clear Resin VS settings, washed in a Form Wash for 5 minutes in >99% Isopropyl Alcohol, and post-cured at 60°C for 15 minutes in a Form Cure.

White Resin V5

An optimally-balanced White Resin for versatile applications

White Resin V5 is an exceptionally bright white General Purpose Resin, offering an optimal balance of fast print speed, high accuracy, presentation-ready appearance, strong mechanical properties, and an easy, reliable workflow.

Create parts that are stiff and strong with a surface finish that rivals injection molding. White Resin V5 is a matte, bright white that captures fine features accurately.

White Resin V5 is a new material formulation that leverages the Form 4 ecosystem to print three times faster than the previous version.

Form and fit prototyping

Anatomical models

Presentation-ready models with fine features and intricate details

Jigs and fixtures



FLGPWH05

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Material Properties	METRIC ¹			IMPERIAL ¹			METHOD
	Green	Post-Cured for 5 min at ambient temperature ²	Post-Cured for 15 min at 60 °C ³	Green	Post-Cured for 5 min at ambient temperature ²	Post-Cured for 15 min at 140 °F ³	
Tensile Properties	METRIC ¹			IMPERIAL ¹			METHOD
Ultimate Tensile Strength	46 MPa	54 MPa	62 MPa	6672 psi	7832 psi	8992 psi	ASTM D638-14
Tensile Modulus	2200 MPa	2500 MPa	2675 MPa	319 ksi	363 ksi	388 ksi	ASTM D638-14
Elongation at Break	22%	15%	13%	22%	15%	13%	ASTM D638-14
Flexural Properties	METRIC ¹			IMPERIAL ¹			METHOD
Flexural Strength	82 MPa	91 MPa	103 MPa	11893 psi	13198 psi	14938 psi	ASTM D790-15
Flexural Modulus	2000 MPa	2450 MPa	2750 MPa	290 ksi	355 ksi	399 ksi	ASTM D790-15
Impact Properties	METRIC ¹			IMPERIAL ¹			METHOD
Notched Izod	36 J/m	34 J/m	32 J/m	0.673 ft-lb/in	0.636 ft-lb/in	0.598 ft-lb/in	ASTM D4812-11
Thermal Properties	METRIC ¹			IMPERIAL ¹			METHOD
Heat Deflection Temp. @ 1.8 MPa	47 °C	54 °C	59 °C	117 °F	129 °F	138 °F	ASTM D648-16
Heat Deflection Temp. @ 0.45 MPa	55 °C	62 °C	71 °C	131 °F	144 °F	160 °F	ASTM D648-16

SOLVENT COMPATIBILITY

Percent weight gain over 24 hours for a printed 1 x 1 x 1 cm cube immersed in respective solvent:

Solvent	24 hr weight gain, %	Solvent	24 hr weight gain, %
Acetic Acid 5%	0.9	Mineral oil (Heavy)	0.2
Acetone	4.9	Mineral oil (Light)	0.2
Bleach ~5% NaOCl	0.7	Salt Water (3.5% NaCl)	0.8
Butyl Acetate	0.3	Skydrol 5	0.5
Diesel Fuel	0.1	Sodium Hydroxide solution (0.025% PH 10)	0.8
Diethyl glycol Monomethyl Ether	1.0	Strong Acid (HCl conc)	0.5
Hydraulic Oil	0.2	Tripropylene glycol monomethyl ether	0.3
Hydrogen peroxide (3%)	0.9	Water	0.8
Isooctane (aka gasoline)	< 0.1	Xylene	< 0.1
Isopropyl Alcohol	0.3		

¹ Material properties may vary based on part geometry, print orientation, print settings, temperature, and disinfection or sterilization methods used.

² Data was obtained from parts printed on a Form 4 printer with 100 µm White Resin V5 settings, washed in a Form Wash for 5 minutes in >99% Isopropyl Alcohol, and post-cured at room temperature for 5 minutes in a Form Cure.

³ Data was obtained from parts printed on a Form 4 printer with 100 µm White Resin V5 settings, washed in a Form Wash for 5 minutes in >99% Isopropyl Alcohol, and post-cured at 60°C for 15 minutes in a Form Cure.

Grey Resin V5

An optimally-balanced Grey Resin for versatile applications

Grey Resin V5 is an exceptionally versatile General Purpose Resin, offering an optimal balance of fast print speed, high accuracy, presentation-ready appearance, strong mechanical properties, and an easy, reliable workflow.

Create parts that are stiff and strong with a surface finish that rivals injection molding. Grey Resin V5 has a rich, matte color that captures fine features accurately.

Grey Resin V5 is a new material formulation that leverages the Form 4 ecosystem to print three times faster than the previous version.

Form and fit prototyping

General dental models

Presentation-ready models with fine features and intricate details

Jigs and fixtures



FLGPGR05

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Material Properties		METRIC ¹			IMPERIAL ¹			METHOD
		Green	Post-Cured for 5 min at ambient temperature ²	Post-Cured for 15 min at 60 °C ³	Green	Post-Cured for 5 min at ambient temperature ²	Post-Cured for 15 min at 140 °F ³	
Tensile Properties		METRIC ¹			IMPERIAL ¹			METHOD
Ultimate Tensile Strength		46 MPa	54 MPa	62 MPa	6672 psi	7832 psi	8992 psi	ASTM D638-14
Tensile Modulus		2200 MPa	2500 MPa	2675 MPa	319 ksi	363 ksi	388 ksi	ASTM D638-14
Elongation at Break		22%	15%	13%	22%	15%	13%	ASTM D638-14
Flexural Properties		METRIC ¹			IMPERIAL ¹			METHOD
Flexural Strength		82 MPa	91 MPa	103 MPa	11893 psi	13198 psi	14938 psi	ASTM D790-15
Flexural Modulus		2000 MPa	2450 MPa	2750 MPa	290 ksi	355 ksi	399 ksi	ASTM D790-15
Impact Properties		METRIC ¹			IMPERIAL ¹			METHOD
Notched Izod		36 J/m	34 J/m	32 J/m	0.673 ft-lb/in	0.636 ft-lb/in	0.598 ft-lb/in	ASTM D4812-11
Thermal Properties		METRIC ¹			IMPERIAL ¹			METHOD
Heat Deflection Temp. @ 1.8 MPa		54 °C	54 °C	59 °C	129 °F	129 °F	138 °F	ASTM D648-16
Heat Deflection Temp. @ 0.45 MPa		62 °C	62 °C	71 °C	144 °F	144 °F	160 °F	ASTM D648-16

SOLVENT COMPATIBILITY

Percent weight gain over 24 hours for a printed and post-cured 1 x 1 x 1 cm cube immersed in respective solvent:

Solvent	24 hr weight gain, %	Solvent	24 hr weight gain, %
Acetic Acid 5%	0.9	Mineral oil (Heavy)	0.2
Acetone	4.9	Mineral oil (Light)	0.2
Bleach ~5% NaOCl	0.7	Salt Water (3.5% NaCl)	0.8
Butyl Acetate	0.3	Skydrol 5	0.5
Diesel Fuel	0.1	Sodium Hydroxide solution (0.025% PH 10)	0.8
Diethyl glycol Monomethyl Ether	1.0	Strong Acid (HCl conc)	0.5
Hydraulic Oil	0.2	Tripropylene glycol	0.3
Hydrogen peroxide (3%)	0.9	monomethyl ether	0.8
Isooctane (aka gasoline)	< 0.1	Water	< 0.1
Isopropyl Alcohol	0.3	Xylene	

¹ Material properties may vary based on part geometry, print orientation, print settings, temperature, and disinfection or sterilization methods used.

² Data was obtained from parts printed on a Form 4 printer with 100 µm Grey Resin V5 settings, washed in a Form Wash for 5 minutes in 99% Isopropyl Alcohol, and post-cured at room temperature for 5 minutes in a Form Cure.

³ Data was obtained from parts printed on a Form 4 printer with 100 µm Grey Resin V5 settings, washed in a Form Wash for 5 minutes in 99% Isopropyl Alcohol, and post-cured at 60°C for 15 minutes in a Form Cure.

Black Resin V5

An optimally-balanced Black Resin for versatile applications

Black Resin V5 is an exceptionally rich, deep black General Purpose Resin, offering an optimal balance of fast print speed, high accuracy, presentation-ready appearance, strong mechanical properties, and an easy, reliable workflow.

Create parts that are stiff and strong with a surface finish that rivals injection molding. Black Resin V5 has a rich, matte color that captures fine features accurately.

Black Resin V5 is a new material formulation that leverages the Form 4 ecosystem to print three times faster than the previous version.

Form and fit prototyping

Enclosures and housings

Presentation-ready models with fine features and intricate details

Jigs and fixtures



FLGPBK05

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Material Properties	METRIC ¹			IMPERIAL ¹			METHOD
	Green	Post-Cured for 5 min at ambient temperature ²	Post-Cured for 15 min at 60 °C ³	Green	Post-Cured for 5 min at ambient temperature ²	Post-Cured for 15 min at 140 °F ³	
Tensile Properties	METRIC ¹			IMPERIAL ¹			METHOD
Ultimate Tensile Strength	48 MPa	57 MPa	61 MPa	6962 psi	8267 psi	8847 psi	ASTM D638-14
Tensile Modulus	2200 MPa	2450 MPa	2700 MPa	319 ksi	363 ksi	388 ksi	ASTM D638-14
Elongation at Break	19%	14%	10%	19%	14%	10%	ASTM D638-14
Flexural Properties	METRIC ¹			IMPERIAL ¹			METHOD
Flexural Strength	82 MPa	91 MPa	103 MPa	11893 psi	13198 psi	14938 psi	ASTM D790-15
Flexural Modulus	2000 MPa	2450 MPa	2750 MPa	290 ksi	355 ksi	399 ksi	ASTM D790-15
Impact Properties	METRIC ¹			IMPERIAL ¹			METHOD
Notched Izod	31 J/m	29 J/m		0.580 ft-lb/in	0.542 ft-lb/in		ASTM D4812-11
Thermal Properties	METRIC ¹			IMPERIAL ¹			
Heat Deflection Temp. @ 1.8 MPa		54 °C	57 °C		129 °F	135 °F	
Heat Deflection Temp. @ 0.45 MPa		61 °C	69 °C		142 °F	156 °F	ASTM D648-16

SOLVENT COMPATIBILITY

Percent weight gain over 24 hours for a printed and post-cured 1 x 1 x 1 cm cube immersed in respective solvent:

Solvent	24 hr weight gain, %	Solvent	24 hr weight gain, %
Acetic Acid 5%	0.9	Mineral oil (Heavy)	0.2
Acetone	4.9	Mineral oil (Light)	0.2
Bleach -5% NaOCl	0.7	Salt Water (3.5% NaCl)	0.8
Butyl Acetate	0.3	Skydrol 5	0.5
Diesel Fuel	0.1	Sodium Hydroxide solution (0.025% PH 10)	0.8
Diethyl glycol Monomethyl Ether	1.0	Strong Acid (HCl conc)	0.5
Hydraulic Oil	0.2	Tripropylene glycol monomethyl ether	0.3
Hydrogen peroxide (3%)	0.9	Water	0.8
Isooctane (aka gasoline)	< 0.1	Xylene	< 0.1
Isopropyl Alcohol	0.3		

¹ Material properties may vary based on part geometry, print orientation, print settings, temperature, and disinfection or sterilization methods used.

² Data was obtained from parts printed on a Form 4 printer with 100 µm Black Resin V5 settings, washed in a Form Wash for 5 minutes in 99% Isopropyl Alcohol, and post-cured at room temperature for 5 minutes in a Form Cure.

³ Data was obtained from parts printed on a Form 4 printer with 100 µm Black Resin V5 settings, washed in a Form Wash for 5 minutes in 99% Isopropyl Alcohol, and post-cured at 60 °C for 15 minutes in a Form Cure.

Fast Model Resin

Formlabs' fastest resin, capable of printing at speeds up to 100mm/hr

Fast Model Resin is capable of printing dental models in less than 10 minutes or large prototypes in less than 2 hours. This highly accurate resin leverages the Form 4 ecosystem to print three times faster than previous formulations of Draft Resin. Use 200 micron settings for fastest print speeds, or use 100 micron settings for more detailed models.

Initial prototypes

Rapid design iterations

Dental models for thermoforming aligners



V1 **FLFMGR01**

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Material Properties		METRIC ¹			IMPERIAL ¹			METHOD
		Green	Post-Cured for 5 min at ambient temperature ²	Post-Cured for 15 min at 60 °C ³	Green	Post-Cured for 5 min at ambient temperature ²	Post-Cured for 15 min at 140 °F ³	
Tensile Properties		METRIC ¹			IMPERIAL ¹			METHOD
Ultimate Strength	Tensile	46 MPa	55 MPa	62 MPa	6670 psi	7980 psi	8990 psi	ASTM D638-14
		2.18 GPa	2.48 GPa	2.67 GPa	320 ksi	360 ksi	390 ksi	ASTM D638-14
		22%	15%	11%	22%	15%	11%	ASTM D638-14
Flexural Properties		METRIC ¹			IMPERIAL ¹			METHOD
Flexural Strength		74 MPa	98 MPa	106 MPa	10700 psi	14200 psi	15400 psi	ASTM D790-15
Flexural Modulus		1.96 GPa	2.60 GPa	2.74 GPa	280 ksi	380 ksi	400 ksi	ASTM D790-15
Impact Properties		METRIC ¹			IMPERIAL ¹			METHOD
Notched Izod		34 J/m	30 J/m	37 J/m	0.64 ft-lb/in	0.56 ft-lb/in	0.69 ft-lb/in	ASTM D4812-11
Thermal Properties		METRIC ¹			IMPERIAL ¹			METHOD
Heat Deflection Temp. @ 1.8 MPa		47 °C	49 °C	61 °C	117 °F	120 °F	142 °F	ASTM D648-16
Heat Deflection Temp. @ 0.45 MPa		55 °C	58 °C	76 °C	131 °F	136 °F	167 °F	ASTM D648-16

SOLVENT COMPATIBILITY

Percent weight gain over 24 hours for a printed and post-cured 1 x 1 x 1 cm cube immersed in respective solvent:

Solvent	24 hr weight gain, %	Solvent	24 hr weight gain, %
Acetic Acid 5%	0.6	Mineral oil (Heavy)	0.2
Acetone	8.9	Mineral oil (Light)	0.1
Bleach ~5% NaOCl	0.7	Salt Water (3.5% NaCl)	0.8
Butyl Acetate	0.5	Skydrol 5	1.0
Diesel Fuel	< 0.1	Sodium Hydroxide solution (0.025% PH 10)	0.8
Diethyl glycol Monomethyl Ether	3.1	Strong Acid (HCl conc)	0.5
		Tripropylene glycol	
Hydraulic Oil	0.2	monomethyl ether	0.7
Hydrogen peroxide (3%)	0.9	Water	0.8
Isooctane (aka gasoline)	< 0.1	Xylene	0.2
Isopropyl Alcohol	0.8		

¹ Material properties may vary based on part geometry, print orientation, print settings, temperature, and disinfection or sterilisation methods used.

² Data was obtained from green parts printed on a Form 4 printer with 100 µm Fast Model Resin settings, washed in a Form Wash for 5 minutes in 99% Isopropyl Alcohol, and air dried without post-cure.

³ Data was obtained from parts printed on a Form 4 printer with 100 µm Fast Model Resin settings, washed in a Form Wash for 5 minutes in 99% Isopropyl Alcohol, and post-cured at room temperature for 5 minutes in a Form Cure.

⁴ Data was obtained from parts printed on a Form 4 printer with 100 µm Fast Model Resin settings, washed in a Form Wash for 5 minutes in 99% Isopropyl Alcohol, and post-cured at 60°C for 15 minutes in a Form Cure.

⁵ Fast Model Resin was tested at NAMSA World Headquarters, OH, USA.

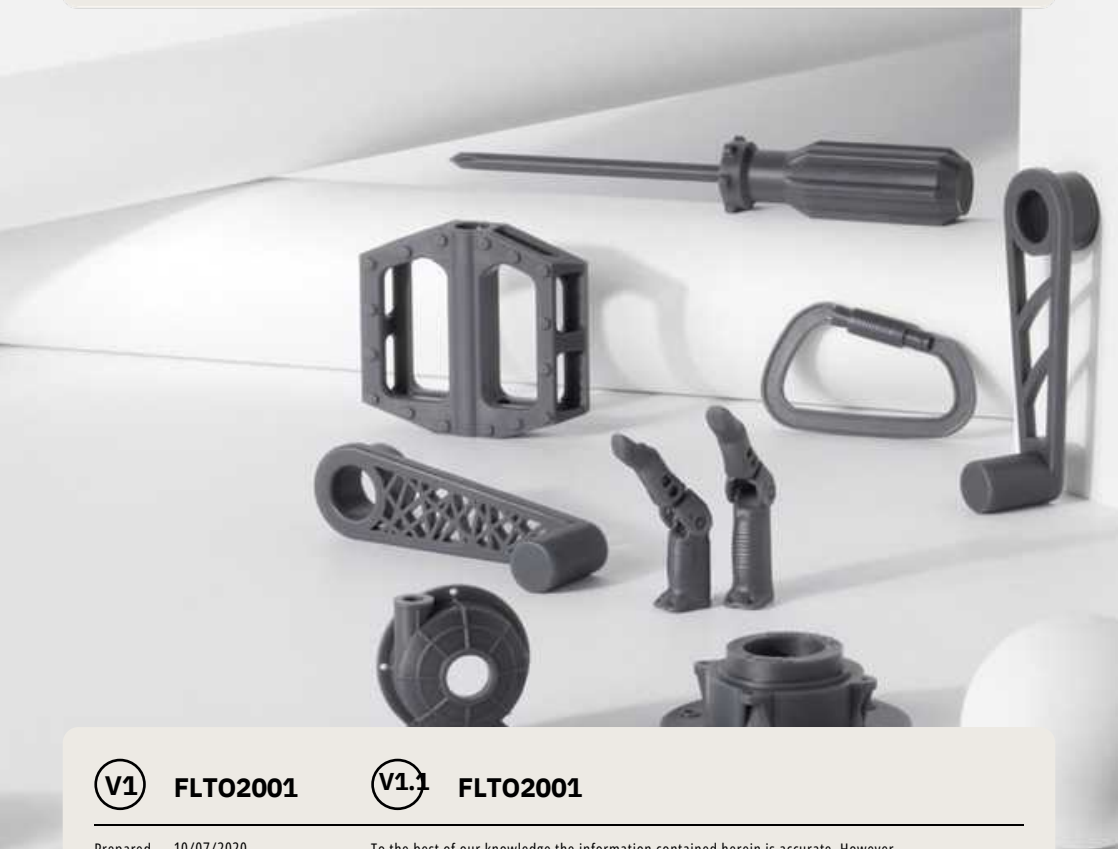
Tough 2000 Resin

Tough2000ResinisthestrongestandstiffestmaterialinourfunctionalfamilyofToughand Durable Resins.ChooseTough2000Resinforprototypingstrongandsturdypartsthatshould not bend easily.

Strong and stiff prototypes

Sturdy jigs and fixtures

ABS-like strength and stiffness



FLT02001



FLT02001

Prepared 10/07/2020

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Material Properties	METRIC ¹			IMPERIAL ¹			METHOD
	Green ²	Low Warp Cure (Room Temp) ³	Full Properties Cure (70 °C) ⁴	Green ²	Low Warp Cure (Room Temp) ³	Full Properties Cure (70 °C) ⁴	
Tensile Properties	METRIC ¹			IMPERIAL ¹			METHOD
Ultimate Tensile Strength	34 MPa	42 MPa	46 MPa	6092 psi	6092 psi	6672 psi	ASTM D638-14
Tensile Modulus Elongation at	1630 MPa	1960 MPa	2100 MPa	284 ksi	284 ksi	305 ksi	ASTM D638-14
Break	86%	51%	44%	54%	51%	44%	ASTM D638-14
Flexural Properties	METRIC ¹			IMPERIAL ¹			METHOD
Flexural Strength	49 MPa	67 MPa	71 MPa	7107 psi	9718 psi	10298 psi	ASTM D790-17
Flexural Modulus	1320 MPa	1760 MPa	1810 MPa	191 ksi	255 ksi	263 ksi	ASTM D790-17
Impact Properties	METRIC ¹			IMPERIAL ¹			METHOD
Notched Izod	79 J/m	40 J/m	41 J/m	1.5 ft-lb/in	0.75 ft-lb/in	0.77 ft-lb/in	ASTM D256-10
Unnotched Izod	208 J/m	Not Tested	715 J/m	3.9 ft-lb/in	Not Tested	13 ft-lb/in	ASTM D4812-11
Gardner at 1/32" (0.97 mm) thickness	Not Tested	Not Tested	1.1 J	Not Tested	Not Tested	10 in-lb	ASTM D5420-21
Fracture Properties	METRIC ¹			IMPERIAL ¹			METHOD
Maximum Stress Intensity Factor (K _{max})	Not Tested	Not Tested	1.2 MPa · m ^{1/2}	Not Tested	Not Tested	1090 psi · in ^{1/2}	ASTM D5045-14
	Not Tested	Not Tested	115 J/m ²	Not Tested	Not Tested	7.9 ft-lb/ft ²	ASTM D5045-14
Work of Fracture (W _f)	METRIC ¹			IMPERIAL ¹			METHOD
Thermal Properties							
Heat Deflection Temp. @ 1.8 MPa	42 °C	48 °C	50 °C	108 °F	118 °F	122 °F	ASTM D648-16
Heat Deflection Temp. @ 0.45 MPa	48 °C	54 °C	59 °C	118 °F	129 °F	138 °F	ASTM D648-16
Thermal Expansion (0-150°C)	107 µm/m/°C	Not Tested	91 µm/m/°C	59 µin/in/°F	Not Tested	50 µin/in/°F	ASTM E831-13

¹ Material properties can vary with part geometry, print orientation, print settings, and temperature.

² Data was obtained from green parts, printed using Form 4, 100 µm, Tough 2000 settings, without additional treatments.

³ Data was obtained from parts printed using Form 4, 100 µm, Tough 2000 settings and post-cured with a Form Cure (2nd generation) for 7 minutes at 70 °C.

⁴ Data was obtained from parts printed using Form 4, 100 µm, Tough 2000 settings and post-cured with a Form Cure (2nd generation) for 7 minutes at Room Temperature

SOLVENT COMPATIBILITY

Percent weight gain over 24 hours for a printed 1 x 1 x 1 cm cube immersed in respective solvent:

Solvent	24 hr weight gain, %	Solvent	24 hr weight gain, %
Acetic Acid 5%	0.7	Isooctane (aka gasoline)	< 0.1
Acetone	18.8	Mineral oil (light)	0.1
Isopropyl Alcohol	3.7	Mineral oil (Heavy)	0.2
Bleach ~5% NaOCl	0.6	Salt Water (3.5% NaCl)	0.6
Butyl Acetate	6.2	Sodium Hydroxide solution (0.025% PH 10)	0.6
Diesel Fuel	0.1	Water	0.6
Diethyl glycol Monomethyl Ether	5.3	Xylene	4.1
Hydraulic Oil	< 0.1	Strong Acid (HCl conc)	3.0
Skydrol 5	0.9		
Hydrogen peroxide (3%)	0.6		

Tough 1500 Resin V2

Stiff but compliant material with toughness that rivals polypropylene

Prototypes requiring the toughness, compliance and resilience of polypropylene.

Impact resistant jigs and fixtures that survive long term use on the factory floor.

Tough and rugged enclosures with functional elements like self-tapping screw bosses and snap fits.

Parts that need a combination of stiffness and ductility to create compliant mechanisms like latches, flexures, and dampers.



V2 **FLTO1502**

Prepared 18/03/2025

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To the best of our knowledge the information contained herein is accurate. However, Formlabs, Inc. makes no warranty, expressed or implied, regarding the accuracy of these results to be obtained from the use thereof.

Tough 1500 Resin V2 is a resilient material with strength, stiffness, and toughness comparable to polypropylene (PP), offering exceptional resistance to fractures, impacts, and shattering.

Create parts that balance stiffness and ductility, whether for compliant mechanisms like rugged enclosures with self-tapping screws and snap fits. Tough 1500 Resin V2 enables a wide range of applications, from functional prototypes to end-use jigs and fixtures.

Tough 1500 Resin V2 is a new material formulation that leverages the Form 4 Series to deliver 10 times higher fracture toughness than the previous version.

Material Properties	METRIC ¹		IMPERIAL ¹		METHOD
	Green ²	Post-Cured ³	Green ²	Post-Cured ³	
Tensile Properties	METRIC ¹		IMPERIAL ¹		METHOD
Ultimate Tensile Strength	30 MPa	34 MPa	4350 psi	4930 psi	ASTM D638-14
Tensile Modulus	1250 MPa	1460 MPa	181 ksi	212 ksi	ASTM D638-14
Tensile Strength at Yield	30 MPa	34 MPa	4350 psi	4930 psi	ASTM D638-14
Elongation at Yield	5.6%	6.1%	5.6%	6.1 %	ASTM D638-14
Elongation at Break	210%	155%	210%	155%	ASTM D638-14 METHOD ASTM D790-17
Flexural Properties	METRIC ¹		IMPERIAL ¹		METHOD
Flexural Strength	26 MPa	41 MPa	3770 psi	5950 psi	ASTM D790-17 METHOD ASTM D256-10
Flexural Modulus	900 MPa	1370 MPa	130 ksi	199 ksi	
Toughness Properties	METRIC ¹		IMPERIAL ¹		METHOD
Notched Izod	45 J/m	42 J/m	0.84 ft-lb/in	0.79 ft-lb/in	ASTM D4812-11
Unnotched Izod	1080 J/m	910 J/m	20.2 ft-lb/in	17.0 ft-lb/in	
Notched Charpy	8.9 kJ/m ²	7.5 kJ/m ²	4.2 ft-lb/in ²	3.6 ft-lb/in ²	ISO 179-1
Unnotched Charpy	63 kJ/m ²	57 kJ/m ²	30 ft-lb/in ²	27 ft-lb/in ²	ISO 179-1
Gardner Impact Strength at 1/32" (0.79 mm) thickness	7.0 J	5.9 J	62 in-lb	52 in-lb	ASTM D5420-21
Gardner Impact Strength at 1/16" (1.6 mm) thickness	12.4 J	11.1 J	110 in-lb	98 in-lb	ASTM D5420-21
Ross Flex Fatigue at 23°C	11000 cycles	8000 cycles	11000 cycles	8000 cycles	Internal (23°C, 60 Degree deflection at 1 hz)
Fracture Properties	METRIC ¹		IMPERIAL ¹		METHOD
Maximum Stress Intensity Factor (K _{max})					ASTM D5045-14
Work of Fracture (W _i)	1.7 MPa · m ^{1/2}	1.7 MPa · m ^{1/2}	1550 psi · in ^{1/2}	1550 psi · in ^{1/2}	
	1090 J/m ²	1011 J/m ²	74.7 ft-lb/ft ²	69.3 ft-lb/ft ²	ASTM D5045-14

¹ Material properties can vary with part geometry, print orientation, print settings, and temperature.

² Data was obtained from green parts, printed using Form 4, 100 µm, Tough 1500 V2 settings, without additional treatments.

³ Data for post-cured samples were measured on Type I tensile bars printed on a Form 4 printer with 100 µm Tough 1500 Resin V2 settings, washed in a Form Wash for 10 minutes in 99% Isopropyl Alcohol, and post-cured at 70°C for 12 minutes in a Form Cure (2nd generation).

Material Properties	METRIC ¹		IMPERIAL ¹		METHOD
	Green ²	Post-Cured ³	Green ²	Post-Cured ³	
Thermal Properties	METRIC ¹		IMPERIAL ¹		METHOD
Heat Deflection Temp. @ 1.8 MPa	42 °C	53 °C	107 °F	127 °F	ASTM D648-16
Heat Deflection Temp. @ 0.45 MPa	54 °C	66 °C	129 °F	151 °F	ASTM D648-16
Thermal Expansion (0-150 °C)	116 µm/m/°C	99 µm/m/°C	64 µin/in/°F	55 µin/in/°F	ASTM E 831-19
Flammability	Not Tested	HB	Not Tested	HB	UL 94
Electric Properties	METRIC ¹				METHOD
	Green ²		Post-Cured ³		
Dielectric Strength	Not Tested		23.4 kV/mm		ASTM D149-20
Dielectric Constant (50 Hz)	Not Tested		4.5		ASTM D150 (50 Hz)
Dielectric Constant (1 kHz)	Not Tested		3.9		ASTM D150 (1 kHz)
Dissipation Factor (50 Hz)	Not Tested		0.018		ASTM D150 (50 Hz)
Dissipation Factor (1 kHz)	Not Tested		0.013		ASTM D150 (1 kHz)
Volume Resistivity	Not Tested		2.91 * 10 ¹⁵ Ω · cm		ASTM D257-14
Other Properties	METRIC ¹				METHOD
Shore D Hardness	70D		76D		ASTM D2240
Bulk Density	1.12 g/mL				ASTM D792-20
Viscosity at 25 °C	1000 cP				ASTM D792-20
Liquid Density	1.02 g/mL				ASTM D792-20

¹ Material properties can vary with part geometry, print orientation, print settings, and temperature.

² Data was obtained from green parts, printed using Form 4, 100 µm, Tough 1500 V2 settings, without additional treatments.

³ Data for post-cured samples were measured on Type I tensile bars printed on a Form 4 printer with 100 µm Tough 1500 Resin V2 settings, washed in a Form Wash for 10 minutes in 99% Isopropyl Alcohol, and post-cured at 70°C for 12 minutes in a Form Cure (2nd generation).

CHEMICAL COMPATIBILITY

Percent weight gain over 24 hours for a printed 1 x 1 x 1 cm cube immersed in respective solvent:

Solvent	24 hr weight gain, %	Solvent	24 hr weight gain, %
Acetic Acid (5%)	0.5	Mineral Oil (Heavy)	0.3
Acetone	37.3	Mineral Oil (Light)	0.3
Bleach (5% NaOCl)	0.4	Salt water (3.5% NaCl)	0.9
Butyl Acetate	4.5	Skydrol 5	6.9
Diesel	6.9	Sodium Hydroxide Solution (0.025% pH = 10)	0.6
Diethyl Glycol Monomethyl Ether	6.2	Strong Acid (HCl Conc)	0.4
Hydraulic Oil	0.3	TPM	0.9
Hydrogen Peroxide (3%)	0.6	Water	0.8
Isooctane	3.4	Xylene	4.1
Isopropyl Alcohol	15.6		

Chemical Compatibility (ASTM D543)

Tough 1500 Resin V2 was tested for chemical compatibility according to ASTM D543. The influence of various chemicals was tested by measuring flexural modulus and strength after different exposure times. Exposed samples were stored in containers and fully immersed in the test chemicals for 1 day and 1 week. After removal, exposed samples were washed and conditioned for 24 hours at 22°C before mechanical testing. Mechanical testing was conducted according to ASTM D638 at standard lab conditions (22°C). Results are reported as a % difference from the measured values of non-exposed samples.

Chemical	Exposure Time	Relative Change in Flexural Modulus (%)	Relative Change in Flexural Strength (%)	Relative Change in Mass (%)
Isopropanol	1 day	-41%	-47%	8.7%
	1 week	-69%	-77%	23.6%
Acetone	1 day	-51%	-59%	42.0%
	1 week	-46%	-54%	42.0%
NaOH (10%)	1 day	0%	-1%	0.3%
	1 week	1%	2%	0.5%
HCl (10%)	1 day	0%	1%	0.3%
	1 week	3%	0%	0.4%
Deionized Water	1 day	2%	0%	0.3%
	1 week	0%	-2%	0.7%
Hydrogen Peroxide (3%)	1 day	-1%	-2%	0.4%
	1 week	0%	0%	0.7%
Bleach (6%)	1 day	1%	1%	0.4%
	1 week	3%	3%	0.5%
Diesel Fuel	1 day	-16%	-15%	2.6%
	1 week	-54%	-55%	7.9%
Motor Oil (5W-30)	1 day	1%	-1%	-1.8%
	1 week	2%	1%	0.1%
Skydrol 5	1 day	-25%	-24%	3.9%
	1 week	-44%	-41%	6.6%

Durable Resin

Durable Resin is the most pliable, impact resistant, and lubricious material in our functional family of Tough and Durable Resins. Choose Durable Resin for squeezable parts and low-friction assemblies.

Squeezable prototypes

Impact resistant jigs

Low friction and non-degrading surfaces

Polyethylene-like strength and stiffness



V2 **FLDUCL02**

V2.1 **FLDUCL21**

Prepared 10/07/2020

Rev. 02 26/06/2024

To the best of our knowledge the information contained herein is accurate. However, Formlabs, Inc. makes no warranty, expressed or implied, regarding the accuracy of these results to be obtained from the use thereof.

Material Properties	METRIC ¹		IMPERIAL ¹		METHOD
	Green ²	Post-Cured ³	Green ²	Post-Cured ³	
Tensile Properties	METRIC ¹		IMPERIAL ¹		METHOD
Ultimate Tensile Strength Tensile	13 MPa	28 MPa	1900 psi	3980 psi	ASTM D638-14
Modulus	0.24 GPa	1.0 GPa	34 ksi	149 ksi	ASTM D638-14
Elongation at Break	75%	55%	75%	55%	ASTM D638-14
Flexural Properties	METRIC ¹		IMPERIAL ¹		METHOD
Flexural Strength	1.0 MPa	24 MPa	149 psi	3420 psi	ASTM D790-15
Flexural Modulus	0.04 GPa	0.66 GPa	5.58 ksi	94.1 ksi	ASTM D790-15
Impact Properties	METRIC ¹		IMPERIAL ¹		METHOD
Notched Izod	127 J/m	114 J/m	2.37 ft-lb/in	2.13 ft-lb/in	ASTM D256-10
Unnotched Izod	972 J/m	710 J/m	18.2 ft-lb/in	13.3 ft-lb/in	ASTM D4812-11
Thermal Properties	METRIC ¹		IMPERIAL ¹		METHOD
Heat Deflection Temp. @ 0.45 MPa	< 30 °C	41 °C	< 86 °F	105 °F	ASTM D648-16
Thermal Expansion (0-150°C)	124 µm/m/°C	106 µm/m/°C	69.1 µin/in/°F	59 µin/in/°F	ASTM E831-13

SOLVENT COMPATIBILITY

Percent weight gain over 24 hours for a printed and post-cured 1 x 1 x 1 cm cube immersed in respective solvent:

Solvent	24 hr weight gain, %	Solvent	24 hr weight gain, %
Acetic Acid 5%	1.3	Isooctane (aka gasoline)	< 1
Acetone	Sample cracked	Mineral oil (light)	< 1
Isopropyl Alcohol	5.1	Mineral oil (Heavy)	< 1
Bleach –5% NaOCl	< 1	Salt Water (3.5% NaCl)	< 1
Butyl Acetate	7.9	Sodium Hydroxide solution (0.025% PH 10)	< 1
Diesel Fuel	< 1	Water	< 1
Diethyl glycol monomethyl ether	7.8	Xylene	6.5
Hydraulic Oil	< 1	Strong Acid (HCl conc)	Distorted
Skydrol 5	1.3		
Hydrogen peroxide (3%)	1		

¹ Material properties can vary with part geometry, print orientation, print settings, and temperature.

² Data was obtained from green parts, printed using Form 2, 100 µm, Durable settings, without additional treatments.

³ Data was obtained from parts printed using Form 2, 100 µm, Durable settings and post-cured with a Form Cure for 60 minutes at 60 °C.

Flexible 80A Resin

Flexible 80A Resin is the most stiff soft-touch material in our library of Flexible and Elastic Resins, with an 80A Shore durometer to simulate the flexibility of rubber or TPU.

Balancing softness with strength, Flexible 80A Resin can withstand bending, flexing, and compression, even through repeated cycles. This material is well-suited for cushioning, damping, and shock absorption.

Cartilage and ligament anatomy

Seals, gaskets, masks

Handles, grips, overmolds



FLFL8001



FLFL8011

Prepared 10/07/2020

Rev. 02 26/06/2024

To the best of our knowledge the information contained herein is accurate. However, Formlabs, Inc. makes no warranty, expressed or implied, regarding the accuracy of these results to be obtained from the use thereof.

Material Properties	METRIC ¹		IMPERIAL ¹		METHOD
	Green	Post-Cured ²	Green	Post-Cured ²	
Tensile Properties	METRIC ¹		IMPERIAL ¹		METHOD
Ultimate Tensile Strength ³	3.7 MPa	8.9 MPa	539 psi	1290 psi	ASTM D412-06 (A)
Stress at 50% Elongation	1.5 MPa	3.1 MPa	218 psi	433 psi	ASTM D412-06 (A)
Stress at 100% Elongation	3.5 MPa	6.3 MPa	510 psi	909 psi	ASTM D412-06 (A)
Elongation at Break	100%	120%	100%	120%	ASTM D412-06 (A)
Shore Hardness	70A	80A	70A	80A	ASTM 2240
Compression Set (23 °C for 22 hours)	Not Tested	3%	Not Tested	3%	ASTM D395-03 (B)
Compression Set (70 °C for 22 hours)	Not Tested	5%	Not Tested	5%	ASTM D395-03 (B)
Tear Strength ⁴	11 kN/m	24 kN/m	61 lb/in	137 lb/in	ASTM D624-00
Ross Flex Fatigue at 23 °C	Not Tested	>200,000 cycles	Not Tested	>200,000 cycles	ASTM D1052, (notched), 60° bending, 100 cycles/minute
Ross Flex Fatigue at -10 °C	Not Tested	>50,000 cycles	Not Tested	>50,000 cycles	ASTM D1052, (notched), 60° bending, 100 cycles/minute
Bayshore Resilience	Not Tested	28%	Not Tested	28%	ASTM D2632
Thermal Properties	METRIC ¹		IMPERIAL ¹		METHOD
Glass transition temperature (Tg)	Not Tested	27 °C	Not Tested	27 °C	DMA

SOLVENT COMPATIBILITY

Percent weight gain over 24 hours for a printed and post-cured 1 x 1 x 1 cm cube immersed in respective solvent:

Solvent	24 hr weight gain, %	Solvent	24 hr weight gain, %
Acetic Acid 5%	0.9	Isooctane (aka gasoline)	1.6
Acetone	37.4	Mineral oil (light)	0.1
Isopropyl Alcohol	11.7	Mineral oil (Heavy)	< 0.1
Bleach ~5% NaOCl	0.6	Salt Water (3.5% NaCl)	0.5
Butyl Acetate	51.4	Sodium Hydroxide solution (0.025% PH 10)	0.6
Diesel Fuel	2.3	Water	0.7
Diethyl Glycol Monomethyl Ether	19.3	Xylene	64.1
Hydraulic Oil	1.0	Strong Acid (HCl conc)	28.6
Skydrol 5	10.7	Tripropylene Glycol	13.6
Hydrogen peroxide (3%)	0.7	Methyl Ether (TPM)	

¹ Material properties can vary with part geometry, print orientation, print settings, and temperature.

² Data was obtained from parts printed using Form 3, 100 µm, Flexible B0A settings, washed in Form Wash for 10 minutes and post-cured with Form Cure at 60 °C for 10 minutes.

³ Tensile testing was performed after 3+ hours at 23 °C, using a Die C specimen cut from sheets.

⁴ Tear testing was performed after 3+ hours at 23 °C, using a Die C tear specimen directly printed.

Elastic 50A Resin V2

This pliable material is suitable for prototyping transparent parts normally produced with softer rubbers and silicones. Choose Elastic 50A Resin V2 for parts that will bend, stretch, compress, and require transparency.

Compliant features for robotics

Medical models and devices

Wearables and consumer goods prototyping

Special effects props and models



FLELCL02

Prepared 24/01/2024

Rev. 01 24/01/2024

To the best of our knowledge the information contained herein is accurate. However, Formlabs, Inc. makes no warranty, expressed or implied, regarding the accuracy of these results to be obtained from the use thereof.

Material Properties	METRIC ¹		IMPERIAL ¹		METHOD
	Green ²	Post-Cured ³	Green ²	Post-Cured ³	
Mechanical Properties	METRIC ¹		IMPERIAL ¹		METHOD
Ultimate Tensile Strength ³	1.7 MPa	3.4 MPa	249 psi	487 psi	ASTM D412-06 (A)
Stress at 50% Elongation	0.5 MPa	0.9 MPa	74 psi	134 psi	ASTM D412-06 (A)
Stress at 100% Elongation	0.9 MPa	1.7 MPa	133 psi	246 psi	ASTM D412-06 (A)
Elongation at Break	160%				ASTM D412-06 (A)
Shore Hardness	44	55	44	55	ASTM 2240
Compression Set (23 °C for 22 hours)	Not Tested	2.1%	Not Tested	2.1%	ASTM D395-03 (B)
Compression Set (70 °C for 22 hours)	Not Tested	3.1%	Not Tested	3.1%	ASTM D395-03 (B)
Tear Strength ⁴	8.2 kN/m	12.3 kN/m	46.8 lb/in	70.2 lb/in	ASTM D624-00
Ross Flex Fatigue at 23 °C	Not Tested	800	Not Tested	800	ASTM D1052, (notched), 60° bending, 100 cycles/minute
Bayshore Resilience	Not Tested	18%	Not Tested	18%	ASTM D2632
Thermal Properties	METRIC ¹		IMPERIAL ¹		METHOD
Glass transition temperature (Tg)	Not Tested	-34.5 °C	Not Tested	-30.1 °F	DMA
General Properties					
Density	1.01				
Color	Clear				
Viscosity (35 °C)	1400 cPs				

SOLVENT COMPATIBILITY

Percent weight gain over 24 hours for a printed and post-cured 1 x 1 x 1 cm cube immersed in respective solvent:

Solvent	24 hr weight gain, %	Solvent	24 hr weight gain, %
Acetic Acid 5%	1.5	Isooctane (aka gasoline)	15.6
Acetone	43.4	Mineral oil (light)	0.7
Isopropyl Alcohol	39.2	Mineral oil (Heavy)	0.4
Bleach ~5% NaOCl	0.6	Salt Water (3.5% NaCl)	0.6
Butyl Acetate	133.1	Sodium Hydroxide solution (0.025% PH 10)	0.7
Diesel Fuel	7.9	Water	0.7
Diethyl Glycol Monomethyl Ether	31.4	Xylene	163.9
Hydraulic Oil	3.9	Strong Acid (HCl conc)	45.6
Skydrol 5	41.2	Tripropylene Glycol Methyl Ether	43.6
Hydrogen peroxide (3%)	0.9	(TPM)	

¹ Material properties can vary with part geometry, print orientation, print settings, and temperature.

² Data was obtained from parts printed using Form 3, 100 µm, Elastic S0A Resin V2 settings, Elastic S0A Resin V2 post-processing steps.

³ Tensile testing was performed after 3+ hours at 23 °C, using a Die C specimen cut from sheets.

⁴ Tear testing was performed after 3+ hours at 23 °C, using a Die C tear specimen directly printed.

Silicone 40A Resin

Enabled by Formlabs' PureSiliconeTechnology™, Silicone 40A Resin produces 100% silicone parts with excellent elasticity, chemical resistance, and thermal stability.

Seals, gaskets, and connectors for industrial and automotive applications requiring high thermal and chemical resistance

Medical device components, patient-matched prosthesis, and audiology applications

Wearables, grippers, and consumer goods prototypes requiring excellent tear strength and rebound resilience

Soft and Flexible fixtures and casting molds for repeated use



V1 FLSI4001

Prepared 18/08/2023
Rev. 02 01/07/2024

To the best of our knowledge the information contained herein is accurate. However, Formlabs, Inc. makes no warranty, expressed or implied, regarding the accuracy of these results to be obtained from the use thereof.

Material Properties	METRIC	IMPERIAL	METHOD
	Post-Cured ^{1,2,3}	Post-Cured ^{1,2,3}	
Mechanical Properties	METRIC	IMPERIAL	METHOD
Ultimate Tensile Strength	5 MPa	725 psi	ASTM D412-06 Type C, 500 mm/min
Elongation at Break	230%	230%	ASTM D412-06 Type C, 500 mm/min
Tear Strength	12 kN/m	68 lb/in	ASTM D624-00, Type C
Stress at 50% elongation	0.4 MPa	58 psi	ASTM D412-06 Type C, 500 mm/min
Stress at 100% elongation	1 MPa	145 psi	ASTM D412-06 Type C, 500 mm/min
Stress at 150% elongation	2.1 MPa	305 psi	ASTM D412-06 Type C, 500 mm/min
Compression Set 23 °C for 22 hours	20%		ASTM D395-03 (B)
Bayshore Resilience	34%		ASTM D2632
Ross Flexing Fatigue at 23 °C	> 500,000 cycles		ASTM D1052, (notched), 60° bending, 100 cycles/minute
Ross Flexing Fatigue at -10 °C	> 500,000 cycles		ASTM D1052, (notched), 60° bending, 100 cycles/minute
General Properties	METRIC	IMPERIAL	METHOD
Shore Hardness	40A		ASTM 2240
Color	Dark grey		
Viscosity (@ 35 °C)	7800 cP		
Thermal Properties	METRIC	IMPERIAL	METHOD
Glass Transition Temperature	-107 °C	-161 °F	ASTM D4065

BIOCOMPATABILITY

Silicone 40A Resin has been evaluated as a skin contacting device in accordance with ISO 10993-1, and passed the requirements for the following biocompatibility endpoints:

ISO Standard	Description ^{4,5}
ISO 10993-5:2009	Not cytotoxic
ISO 10993-23:2021	Not an irritant
ISO 10993-10:2021	Not a sensitizer

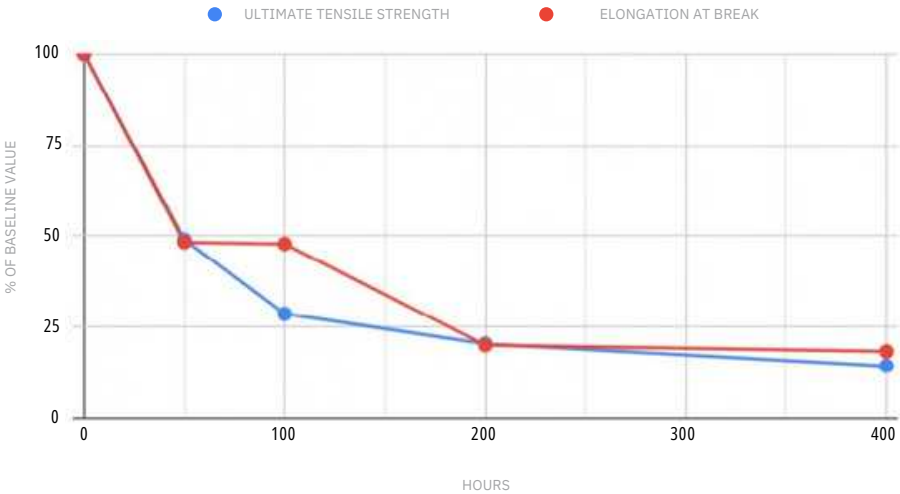
¹ The measured properties have been determined through internal testing and will be updated with results from an external lab.

² Material properties may vary based on part geometry, print orientation, print settings, temperature, and disinfection or sterilization methods used.

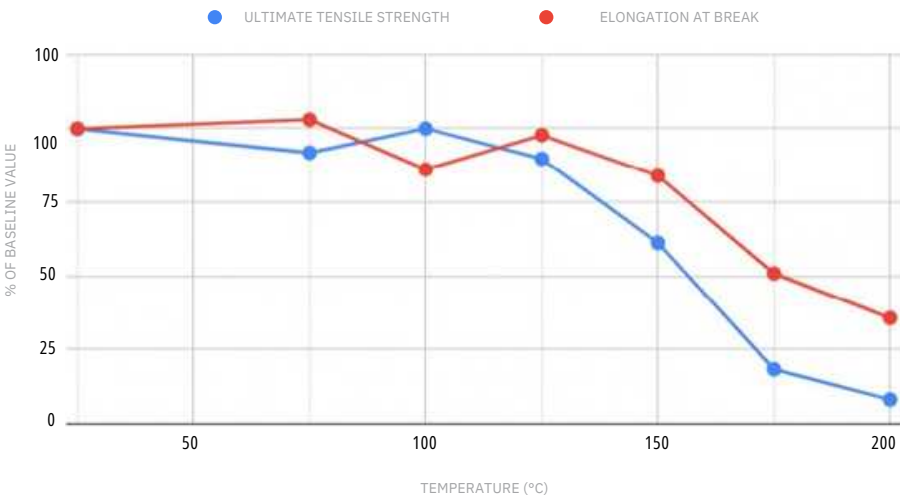
³ Data for post-cured samples were measured on Type C tensile bars printed on a Form 3 printer with 100 µm Silicone 40A Resin settings, washed in a Form Wash for 20 minutes in 80% Isopropyl Alcohol / 20% Butyl Acetate, and post-cured at 60 °C for 30 minutes submerged in water in a Form Cure.

⁴ Silicone 40A Resin was tested at NAMS World Headquarters, OH, USA.

MECHANICAL PROPERTIES AFTER UV AGING



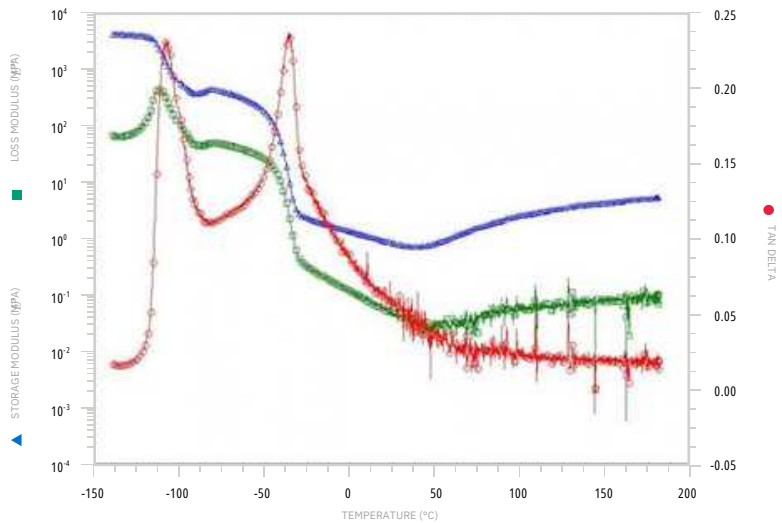
MECHANICAL PROPERTIES AFTER 24 HOURS THERMAL AGING



Aerospace Specific Testing

Outgassing	"Total Mass Loss (TML): 1.34% Collected Volatile Condensable Material (CVCN): 0.61% Water Vapor Recovered (WVR): 0.2%"	ASTM E595-15
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SILICONE 40A RESIN DYNAMIC MECHANICAL ANALYSIS (DMA)



A DMA curve from -150 °C to 180 °C at 3 °C/min is shown. A glass transition is observed at -107 °C, and a crystalline melting transition is observed at -37 °C followed by a rubbery plateau to the conclusion of the test at 180 °C.

SOLVENT COMPATIBILITY

Percent weight gain over 24 hours for a printed and post-cured 1 x 1 x 1 cm cube immersed in respective solvent:

Cleaning Chemicals	24 hr weight gain, %	Industrial Fluids	24 hr weight gain, %
Acetone	11.5	Gasoline (ISO 1817, liquid C)	69.8
Bleach ~5% NaOCl	< 0.1	Diesel (Chevron #2)	32.9
Distilled Water	< 0.1	Skydrol 5	23.2
Strong Acid/Base/Alcohol	24 hr weight gain, %	Hydraulic Oil	10
Acetic Acid (5%)	< 0.1	Diethyl glycol monomethyl ether	2.5
Hydrochloric Acid (10%)	0.4	Mineral oil (Heavy)	1.6
Sodium hydroxide solution (0.025% pH = 10)	< 0.1	Mineral oil (Light)	2
Salt Water (3.5% NaCl)	< 0.1		-3.0
Isopropyl Alcohol	5.9		0.3
Hydrogen peroxide (3%)	< 0.1		2.0
Butyl Acetate	92.3		

Rigid 10K Resin

This highly glass-filled resin is the stiffest material in our engineering portfolio. Choose Rigid 10K Resin for precise industrial parts that need to withstand significant load without bending. Rigid 10K Resin has a smooth matte finish and is highly resistant to heat and chemicals.

Short-run injection molds and inserts

Simulates stiffness of glass and fiber-filled thermoplastics

Heat resistant and fluid exposed components, jigs, and fixtures

Aerodynamic test models



FLRG1001



FLRG1011

Prepared 10/07/2020

Rev. 06 26/06/2024

To the best of our knowledge the information contained herein is accurate. However, Formlabs, Inc. makes no warranty, expressed or implied, regarding the accuracy of these results to be obtained from the use thereof.

Material Properties	METRIC				METHOD
	Green	Post-Cured for 60 min at 70 °C	Post-Cured for 60 min at 70 °C and 125min at 90 °C	Post-Cured for 60 min at 70 °C and Media Blasted	
Tensile Properties	METRIC				METHOD
Ultimate Tensile Strength	55 MPa	65 MPa	53 MPa	88 MPa	ASTM D638-14
Tensile Modulus	7.5 GPa	10 GPa		11 GPa	ASTM D638-14
Elongation at Break	2%	1%		1.7%	ASTM D638-14
Flexural Properties	METRIC				METHOD
Flexural Strength	84 MPa	126 MPa	103 MPa	158 MPa	ASTM D790-15
Flexural Modulus	6 GPa	9 GPa	10 GPa	9.9 GPa	ASTM D790-15
Impact Properties	METRIC				METHOD
Notched Izod	16 J/m	16 J/m	18 J/m	20 J/m	ASTM D256-10
Unnotched Izod	41 J/m	47 J/m	41 J/m	130 J/m	ASTM D4812-11
Thermal Properties	METRIC				METHOD
Heat Deflection Temp. @ 0.45 MPa	65 °C	163 °C	218 °C	238 °C	ASTM D648-16
Heat Deflection Temp. @ 1.8 MPa	56 °C	82 °C	110 °C	92 °C	ASTM D648-16
Thermal Expansion, 0-150 °C	48 µm/m/°C	47 µm/m/°C	46 µm/m/°C	41 µm/m/°C	ASTM E831-13

Material Properties	IMPERIAL				METHOD
	Green	Post-Cured for 60 min at 70 °C ¹	Post-Cured for 60 min at 70 °C and 125min at 90 °C ¹	Post-Cured for 60 min at 70 °C and Media Blasted	
Tensile Properties	IMPERIAL				METHOD
Ultimate Tensile Strength	7980 psi	9460 psi	7710 psi	12700 psi	ASTM D638-14
Tensile Modulus	1090 ksi	1480 ksi	1460 ksi	1600 ksi	ASTM D638-14
Elongation at Break	2%	1%		1.70%	ASTM D638-14
Flexural Properties	IMPERIAL				METHOD
Flexural Strength	12200 psi	18200 psi	15000 psi	22900 psi	ASTM D790-15
Flexural Modulus	905 ksi	1360 ksi	1500 ksi	1440 ksi	ASTM D790-15
Impact Properties	IMPERIAL				METHOD
Notched Izod	0.3 ft-lb/in			0.37 ft-lb/in	ASTM D256-10
Unnotched Izod	0.8 ft-lb/in	0.9 ft-lb/in	0.7 ft-lb/in	2.5 ft-lb/in	ASTM D4812-11
Thermal Properties	IMPERIAL				METHOD
Heat Deflection Temp. @ 0.45 MPa	149 °F	325 °F	424 °F	460 °F	ASTM D648-16
Heat Deflection Temp. @ 1.8 MPa	133 °F	180 °F	230 °F	198 °F	ASTM D648-16
Thermal Expansion, 0-150 °C	27 µin/in/°F	26 µin/in/°F	26 µin/in/°F	23 µin/in/°F	ASTM E831-13

ELECTRICAL CHARACTERIZATION

Property	Frequency	Value	Standard
Dielectric Constant (D _k)	1 GHz	3.4	ASTM D150-22
Dielectric Constant (D _k)	10 GHz	3.3	ASTM D2520-21
Loss Tangent (D _i)	1 GHz	0.036	ASTM D150-22
Loss Tangent (D _i)	10 GHz	0.0074	ASTM D2520-21
Volume Resistivity	-	1.1 x 10 ¹⁵ Ω•cm	ASTM D257-14
Surface Resistivity	-	6.9 x 10 ¹³ Ω	ASTM D257-14
Dielectric Strength	-	458 V/mil	ASTM D149-20

TOXIC GAS GENERATION

Testing Standard BSS 7239 (comparable to NFPA No. 258)	Maximum allowed concentration per BSS 7239 (ppm)	Flaming Mode (ppm)	Non-Flaming Mode (ppm)
Hydrogen Cyanide (HCN)	150	1	0.5
Carbon Monoxide (CO)	3500	50	10
Nitrous Oxides (NO _x)	100	< 2	
Sulfur Dioxide (SO ₂)	100	< 1	
Hydrogen Fluoride (HF)	200	< 1.5	
Hydrogen Chloride (HCl)	500	1	< 1

SMOKE DENSITY

SPECIFIC OPTICAL DENSITY

Testing Standard	@ 90 sec	@ 4 min	Maximum
ASTM E662 Flaming Mode	2	95	132
ASTM E662 Non-Flaming Mode	0	1	63

FL AMMABILITY

Testing Standard	Rating
UL 94 Section 7 (3 mm)	HB

SOLVENT COMPATIBILITY

Percent weight gain over 24 hours for a printed and post-cured 1 x 1 x 1 cm cube immersed in respective solvent:

Solvent	24 hr weight gain, %	Solvent	24 hr weight gain, %
Acetic Acid 5%	< 0.1	Isooctane (aka gasoline)	0
Acetone	< 0.1	Mineral oil (light)	0.2
Isopropyl Alcohol	< 0.1	Mineral oil (Heavy)	< 0.1
Bleach ~5% NaOCl	0.1	Salt Water (3.5% NaCl)	0.1
Butyl Acetate	0.1	Sodium Hydroxide solution (0.025% PH 10)	0.1
Diesel Fuel	0.1	Water	< 0.1
Diethyl glycol Monomethyl Ether	0.4	Xylene	< 0.1
Hydraulic Oil	0.2	Strong Acid (HCl conc)	0.2
Skydrol 5	0.6	Tripropylene glycol monomethyl ether	0.4
Hydrogen peroxide (3%)	< 0.1		

All testing specimens were printed using Form 3.

¹ Data was obtained from parts printed using Form 3, 100 µm and post-cured with a Form Cure for 60 minutes at 70 °C.

² Data was obtained from parts printed using Form 3, 100 µm and post-cured with a Form Cure for 60 minutes at 70 °C and an additional thermal cure at 90 °C for 125 minutes.

Rigid 4000 Resin

Glass-filled Rigid 4000 Resin prints with a smooth, polished finish and is ideal for stiff and strong parts that can withstand minimal deflection. Consider Rigid 4000 Resin for general load-bearing applications.

Mounts and brackets

Jigs and fixtures

Thin-walled parts

Simulates stiffness of PEEK



FLRGWH01

Prepared 10/07/2020

Rev. 01 10/07/2020

To the best of our knowledge the information contained herein is accurate. However, Formlabs, Inc. makes no warranty, expressed or implied, regarding the accuracy of these results to be obtained from the use thereof.

Material Properties	METRIC ¹		IMPERIAL ¹		METHOD
	Green ²	Post-Cured ³	Green ²	Post-Cured ³	
Tensile Properties	METRIC ¹		IMPERIAL ¹		METHOD
Ultimate Tensile Strength	33 MPa	69 MPa	4786 psi	10007 psi	ASTM D638-14
Tensile Modulus	2.1 GPa	4.1 GPa	305 ksi	595 ksi	ASTM D638-14
Elongation at Break	23%	5.3%	23%	5.3%	ASTM D638-14
Flexural Properties	METRIC ¹		IMPERIAL ¹		METHOD
Flexural Stress at 5% Strain	43 MPa	105 MPa	6236 psi	15229 psi	ASTM D790-15
Flexural Modulus	1.4 GPa	3.4 GPa	203 ksi	493 ksi	ASTM D790-15
Impact Properties	METRIC ¹		IMPERIAL ¹		METHOD
Notched Izod	16 J/m	23 J/m	0.3 ft-lb/in	0.43 ft-lb/in	ASTM D256-10
Thermal Properties	METRIC ¹		IMPERIAL ¹		METHOD
Heat Deflection Temp. @ 1.8 MPa	41 °C	60 °C	105 °F	140 °F	ASTM D648-16
Heat Deflection Temp. @ 0.45 MPa	48 °C	77 °C	118 °F	170 °F	ASTM D648-16
Thermal Expansion (0-150 °C)	64 µm/m/°C	63 µm/m/°C	36 µin/in/°F	35 µin/in/°F	ASTM E831-13

SOLVENT COMPATIBILITY

Percent weight gain over 24 hours for a printed and post-cured 1 x 1 x 1 cm cube immersed in respective solvent:

Solvent	24 hr weight gain, %	Solvent	24 hr weight gain, %
Acetic Acid 5%	0.8	Isooctane (aka gasoline)	< 0.1
Acetone	3.3	Mineral oil (light)	0.2
Isopropyl Alcohol	0.4	Mineral oil (Heavy)	0.2
Bleach ~5% NaOCl	0.7	Salt Water (3.5% NaCl)	0.7
Butyl Acetate	< 0.1	Sodium Hydroxide solution (0.025% PH 10)	0.7
Diesel Fuel	< 0.1	Water	0.7
Diethyl glycol Monomethyl Ether	1.4	Xylene	< 0.1
Hydraulic Oil	0.2	Strong Acid (HCl conc)	5.3
Skydrol 5	1.1		
Hydrogen peroxide (3%)	0.9		

¹ Material properties can vary with part geometry, print orientation, print settings, and temperature.

² Data was obtained from green parts, printed using Form 3, 100 µm, Rigid settings, without additional treatments.

³ Data was obtained from parts printed using Form 3, 100 µm, Rigid settings and post-cured with a Form Cure for 15 minutes at 80 °C.

High Temp Resin

HighTempResin offers a heat deflection temperature (HDT) of 238°C @ 0.45MPa, the highest among Formlabs resins. Use it to print detailed, precise prototypes with high temperature resistance.

Hot air, gas, and fluid flow

Heat resistant mounts, housings, and fixtures

Molds and inserts



FLHTAM02

Prepared 10/07/2020

Rev. 01 10/07/2020

To the best of our knowledge the information contained herein is accurate. However, Formlabs, Inc. makes no warranty, expressed or implied, regarding the accuracy of these results to be obtained from the use thereof.

Material Properties	METRIC ¹			IMPERIAL ¹			METHOD
	Green ²	Post-Cured for 60 min at 60 °C ³	Post-Cured for 120 min at 80 °C and 180 min at 160 °C ⁴	Green ²	Post-Cured for 60 min at 176 °F ³	Post-Cured for 120 min at 248 °F and 180 min at 356 °F ⁴	
Tensile Properties	METRIC ¹			IMPERIAL ¹			METHOD
Ultimate Tensile Strength	21 MPa	58 MPa	49 MPa	3031 psi	8456 psi	7063 psi	ASTM D638-14
Tensile Modulus	0.75 GPa	2.8 GPa	2.8 GPa	109 ksi	399 ksi	406 ksi	ASTM D638-14
Elongation at Break	14%	3.3%	2.3%	14%	3.3%	2.3%	ASTM D638-14
Flexural Properties	METRIC ¹			IMPERIAL ¹			METHOD
Flexural Strength at Break	24 MPa	95 MPa	97 MPa	3495 psi	13706 psi	14097 psi	ASTM D790-15
Flexural Modulus	0.7 GPa	2.6 GPa	2.8 GPa	100 ksi	400 ksi	406 ksi	ASTM D790-15
Impact Properties	METRIC ¹			IMPERIAL ¹			METHOD
Notched Izod	33 J/m	18 J/m	17 J/m	0.61 ft-lb/in	0.34 ft-lb/in	0.32 ft-lb/in	ASTM D256-10
Thermal Properties	METRIC ¹			IMPERIAL ¹			
Heat Deflection Temp. @ 1.8 MPa	44 °C	78 °C	101 °C	111 °F	172 °F	214 °F	ASTM D648-16
Heat Deflection Temp. @ 0.45 MPa	49 °C	120 °C	238 °C	120 °F	248 °F	460 °F	ASTM D648-16
Thermal Expansion	118 µm/m/°C 80 µm/m/°C		75 µm/m/°C	41 µin/in/°F	44 µin/in/°F	41 µin/in/°F	ASTM E831-13

SOLVENT COMPATIBILITY

Percent weight gain over 24 hours for a printed and post-cured 1 x 1 x 1 cm cube immersed in respective solvent:

Solvent	24 hr size gain, %	24 hr weight gain, %	Solvent	24 hr size gain, %	24 hr weight gain, %
Acetic Acid 5%	< 1	< 1	Mineral oil (Light)	< 1	< 1
Acetone	< 1	2	Mineral oil (Heavy)	< 1	< 1
Bleach ~5% NaOCl	< 1	< 1	Salt Water (3.5% NaCl)	< 1	< 1
Butyl Acetate	< 1	< 1	Skydrol 5	< 1	1.1
Diesel Fuel	< 1	< 1	Sodium Hydroxide solution (0.025% PH 10)	< 1	< 1
Diethyl glycol Monomethyl Ether	< 1	1	Strong Acid (HCl conc)	1.2	< 1
Hydraulic Oil	< 1	< 1	Tripropylene glycol monomethyl ether	< 1	< 1
Hydrogen peroxide (3%)	< 1	< 1	Water	< 1	< 1
Isooctane (aka gasoline)	< 1	< 1	Xylene	< 1	< 1
Isopropyl Alcohol	< 1	< 1			

¹ Material properties can vary with part geometry, print orientation, print settings, and temperature.

² Data was obtained from green parts, printed using Form 2, 100 µm, High Temp settings, washed for 5 minutes in Form Wash and air dried without post cure.

³ Data was obtained from parts printed using a Form 2, 100 micron, High Temp settings, and post-cured with Form Cure at 60 °C for 60 minutes.

⁴ Data was obtained from parts printed using a Form 2, 100 micron, High Temp settings, and post-cured with Form Cure at 80 °C for 120 minutes plus an additional thermal cure in a lab oven at 160 °C for 180 minutes.

ESD Resin

Arugged ESD-safe material to improve your electronics manufacturing workflows.

Reduce risk and increase manufacturing yield by 3D-printing custom tools, jigs, and fixtures with ESD Resin that protect your critical electronics components from static discharge. ESD Resin is a cost-effective solution for producing static-dissipative parts designed to endure use on the factory floor.

Anti-static prototypes and end-use parts

Housings for sensitive electronics

Tooling, jigs, and fixtures for electronics manufacturing



FLESDS01

Prepared 12/01/2021

Rev. 01 12/01/2021

To the best of our knowledge the information contained herein is accurate. However, Formlabs, Inc. makes no warranty, expressed or implied, regarding the accuracy of these results to be obtained from the use thereof.

Material Properties	METRIC ^{1,2}	IMPERIAL ^{1,2}	METHOD
	Post-Cured	Post-Cured	
Mechanical Properties	METRIC ^{1,2}	IMPERIAL ^{1,2}	METHOD
Ultimate Tensile Strength	44.2 MPa	6410 psi	ASTM D638-14
Tensile Modulus	1.937 GPa	280.9 ksi	ASTM D638-14
Elongation at Break	12%		ASTM D638-14
Flexural Properties	METRIC ^{1,2}	IMPERIAL ^{1,2}	METHOD
Flexural Strength	61 MPa	8860 psi	ASTM D790-17
Flexural Modulus	1.841 GPa	267 ksi	ASTM D790-17
Impact Properties	METRIC ^{1,2}	IMPERIAL ^{1,2}	METHOD
Notched Izod	26 J/m	0.489 ft-lb/in	ASTM D256-10
Unnotched Izod	277 J/m	5.19 ft-lb/in	ASTM D4812-11
Thermal Properties	METRIC ^{1,2}	IMPERIAL ^{1,2}	METHOD
Heat Deflection Temp. @ 1.8 MPa Heat	54.2 °C	129.6 °F	ASTM D648-18
Deflection Temp. @ 0.45 MPa Thermal	62.2 °C	143.9 °F	ASTM D648-18
Expansion	123.7 µm/m/°C	68.7 µin/in/°F	ASTM E813-13
Electrical Properties	METRIC ^{1,2}	IMPERIAL ^{1,2}	METHOD
Surface Resistivity	10 ⁵ - 10 ⁸ Ω/sq		ANSI/ESD 11.11 ³
Volume Resistivity	10 ⁵ - 10 ⁷ Ω-cm		ANSI/ESD 11.11 ³
Physical Properties	METRIC ^{1,2}	IMPERIAL ^{1,2}	METHOD
Density	1.116 g/cm ³	69.67 lb/ft ³	ASTM D792
Hardness	90 Shore D		ASTM D2240

SOLVENT COMPATIBILITY

Percent weight gain over 24 hours for a printed and post-cured 1 x 1 x 1 cm cube immersed in respective solvent:

Solvent	24 hr weight gain, %	Solvent	24 hr weight gain, %
Acetic Acid 5%	0.5	Mineral oil, heavy	0.1
Acetone	13.	Mineral oil, light	0.1
Bleach ~5% NaOCl	1	Salt Water (3.5% NaCl)	0.6
Butyl Acetate	0.5	Skydrol 5	0.5
Diesel Fuel	3.8 0.2	Sodium hydroxide solution (0.025% pH = 10)	0.7
Diethyl glycol monomethyl ether	3.6	Strong Acid (HCl Conc)	1.4
Hydraulic Oil	0.2	TPM	0.6
Hydrogen peroxide (3%)	0.6	Water	0.7
Isooctane	< 0.1	Xylene	1.60
Isopropyl Alcohol	2.6		

¹ Material properties may vary based on part geometry, print orientation, print settings, temperature, and disinfection or sterilization methods used.

² Data for post-cured samples were measured on Type IV tensile bars printed on a Form 3 printer with 100 µm ESD Resin settings, washed in a Form Wash for 20 minutes in >99% Isopropyl Alcohol, and post-cured at 70°C for X 60 minutes in a Form Cure.

³ ESD Resin was tested at ETS 700 West Park Avenue, Perkasie, PA 18944.

Flame Retardant Resin

For UL94V-0 Certified Parts With Excellent Part Quality and Heat Resistance

Easily and quickly create stiff, creep-resistant, and functional plastic parts that perform well long-term in indoor and industrial environments. FR Resin is self-extinguishing and halogen-free with favorable flame, smoke, and toxicity (FST) ratings.

Custom jigs, fixtures, and replacement parts for industrial environments with high temperatures or ignition sources

Interior parts in airplanes, automobiles, and railways with excellent surface finish

Protective and internal consumer or medical electronics components



V1 **FLFRGR01**

Prepared 13/04/2023

Rev. 02 26/07/2023

To the best of our knowledge the information contained herein is accurate. However, Formlabs, Inc. makes no warranty, expressed or implied, regarding the accuracy of these results to be obtained from the use thereof.

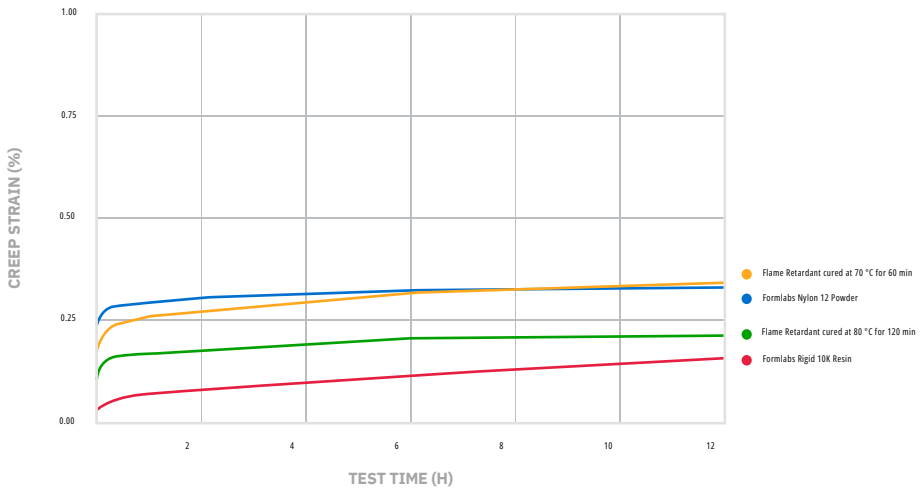
Flammability ^{1,2}	Result			Method
UL 94	V-0 (3 mm)	V-1 (2.5 mm)	HB (1.5 mm)	 Scan to view Blue Card
FAR 25.853 Appendix F, Part I (a) (1) (ii) 12 seconds Vertical Burn	Pass (2.5 mm)			
Smoke Toxicity ^{3,4}	Result			Method
	Ds @ 1.5 min	Ds @ 4 min		
Smoke Generation: Flaming at 3 mm thickness	19.5	285		ASTM E662
Smoke Generation: Flaming at 5 mm thickness	5	114		ASTM E662
Gas Toxicity ^{3,4}	Result			Method
Gas Toxicity at 3 mm thickness	Pass	CO: 56 PPM HCN: 7 PPM HCl: <1 PPM	SO2: <1 PPM (NO + NO2) NOx: <1 PPM	BSS 7239

Material Properties	METRIC ^{3,5}			IMPERIAL ^{3,5}			METHOD
	Green	Post-Cured for 60 min at 120 min 70 °Cat 80 °C	Post-Cured for 60 min at 120 min 70 °Cat 80 °C	Green	Post-Cured for 60 min at 120 min 70 °Cat 80 °C	Post-Cured for 60 min at 120 min 70 °Cat 80 °C	
Mechanical Properties ^{5,6}	METRIC ^{3,5}			IMPERIAL ^{3,5}			METHOD
Ultimate Tensile Strength	24 MPa	38 MPa	41 MPa	3560 psi	5990 psi		ASTM D638-14
Tensile Modulus	1.8 GPa	2.9 GPa	3.1 GPa	263 ksi	430 ksi	446 ksi	ASTM D638-14
Elongation at Break	20%	9.4%	7.1%	20%	9.40%	7.10%	ASTM D638-14
Flexural Properties	METRIC ^{3,5}			IMPERIAL ^{3,5}			METHOD
Flexural Strength	36 MPa	72 MPa	75 MPa	5280 psi	10500 psi	10900 psi	ASTM D790-15
Flexural Modulus	1.3 GPa	2.7 GPa		188 ksi	392 ksi	401 ksi	ASTM D790-15
Impact Properties	METRIC ^{3,5}			IMPERIAL ^{3,5}			METHOD
Notched Izod	19 J/m	22 J/m		0.36 ft-lb/in	0.41 ft-lb/in	0.42 ft-lb/in	ASTM D256-10
Unnotched Izod	227 J/m	241 J/m	257 J/m	4.26 ft-lb/in	4.51 ft-lb/in	4.82 ft-lb/in	ASTM D4812-11
Fracture Properties	METRIC ^{3,5}			IMPERIAL ^{3,5}			METHOD
							ISO 20795-
Maximum Stress Intensity Factor (Kmax)		1.05 MPa · m ^{1/2}	1.11 MPa · m ^{1/2}		956 psi · in ^{1/2}	1009 psi · in ^{1/2}	1:2013(E), Section 8.6
Work of Fracture (Wf)		311 J/m²	277 J/m²		21 ft-lb/ft²	19 ft-lb/ft²	ISO 20795-1:2013(E), Section 8.6
Thermal Properties	METRIC ^{3,5}			IMPERIAL ^{3,5}			METHOD
Heat Deflection Temp. @ 1.8 MPa	45 °C	71 °C	83 °C	113 °F	160 °F	181 °F	ASTM D648-16
Heat Deflection Temp. @ 0.45 MPa	55 °C	94 °C	111 °C	131 °F	201 °F	232 °F	ASTM D648-16
Coefficient of Thermal Expansion, 20°- 80°C		98.6 µm/m/°C	68.1 µm/m/°C		54.8 µin/in/°F	37.8 µin/in/°F	ASTM E813-13
Glass Transition Temperature (Tg)	101 °C	130 °C	144 °C	214 °F	266 °F	291 °F	Peak of tan delta, Heating Rate: 3°Cpm

General Properties	Result	Method
Hardness	Green: 74D Post Cured: 80D	ASTM D2240
Bulk Density	1.25 g/cm ³	ASTM D792-20
Viscosity (25 °C)	4500 - 5000 cP	
Color	Light grey	
Electrical Properties ^{3,5}	Result	Method
Dielectric Strength	15.1 kV/mm	ASTM D149
Dielectric Constant	3.83	ASTM D150, 0.5 MHz
Dielectric Constant	3.82	ASTM D150, 1.0 MHz
Dissipation Factor	0.024	ASTM D150, 0.5 MHz
Dissipation Factor	0.025	ASTM D150, 1 MHz
Volume Resistivity	2.1 x 10 ¹⁵ ohm-cm	ASTM D257
Outgassing ^{3,5}	Result	Method
Total Mass Loss and Collected Volatile Condensable Materials from Outgassing in a Vacuum Environment	Pass Total Mass Loss (TML): 0.87% Collected Volatile Condensable Material (CVCM): <0.01% Water Vapor Recovered (WVR): 0.2%	ASTM E595

Tensile Creep Resistance (ASTM D2990-17)

Creep resistance measurements of Formlabs materials tested at 65 °C and a 1.8 MPa load.



Formlabs Flame Retardant Resin parts have high creep resistance. Post-curing Flame Retardant Resin samples at 80 °C for 120 minutes shows improved creep resistance compared to post-curing at 70 °C for 60 minutes. Flame Retardant Resin samples post-cured at 80 °C and 120 minutes is slightly lower in creep resistance than Rigid 10K Resin samples. Flame Retardant Resin samples post-cured at 70 °C and 60 minutes showed similar creep behavior as Formlabs Nylon 12 SLS Powder.

Accelerated UV Aging^{3,5}

Indoor UV Stability

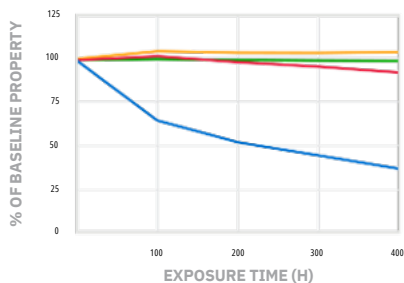
Formlabs evaluated the UV aging performance of Flame Retardant Resin using ASTM D4459, a test standard for xenon-arc exposure of plastics for indoor applications. This test simulates polymer aging due to solar radiation exposure through glass.

Method

ASTM D4459
Standard practice for Xenon-Arc exposure of plastics intended for indoor applications

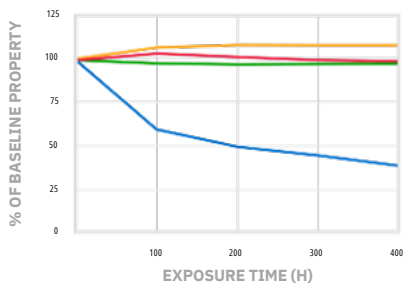
Accelerated UV Aging of Flame Retardant Resin

Post cured at 80 °C for 120 min



Accelerated UV Aging of Flame Retardant Resin

Post cured at 70 °C for 60 min



Accelerated UV Aging

ASTM 4459: Xenon-Arc, 0.8 W/m² at 420 nm, 55 °C, 50% RH
ASTM D638: Type 4, 5 mm/min

- EAB (%)
- UTS (%)
- Modulus (%)
- Impact (%)

Long Term Aging^{3,5}

Heat Aging

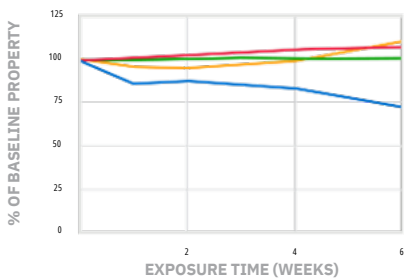
Formlabs evaluated the heat aging performance of Flame Retardant Resin using ASTM D3045, a test method for evaluating heat aging of plastics without load. In this test, mechanical properties of samples placed at 50 °C or 90 °C environments are measured at different durations of time for up to 6 weeks.

Method

ASTM D3045
A test time of 6 weeks at 50 or 90 °C

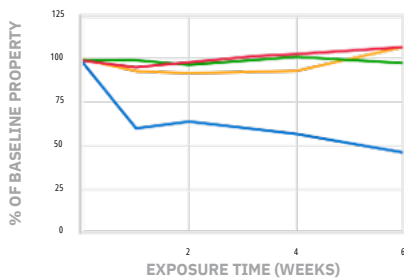
Heat Aging of Flame Retardant Resin at 50 °C

Post cured at 70 °C for 60 min



Heat Aging of Flame Retardant Resin at 90 °C

Post cured at 70 °C for 60 min



Accelerated Heat Aging

ASTM D3045: 50 and 90 °C for 1, 2, 4 and 6 weeks each
ASTM D638: Type 4, 5 mm/min

- EAB (%)
- UTS (%)
- Modulus (%)
- Impact (%)

SOLVENT COMPATIBILITY

Percent weight gain over 24 hours for a printed and post-cured 1 x 1 x 1 cm cube immersed in respective solvent:

Cleaning Chemicals	24 hr weight gain, %
Acetone	2.1
Bleach ~5% NaOCl	0.3
Windex Powerized Formula	0.3
Hydrogen Peroxide (30%)	1
Soapy water	0.2
TPM	0.1
Distilled Water	0.2
Strong Acid/Base/Alcohol	
Hydrochloric Acid (10%)	< 0.1
Sodium Hypochlorite Solution	< 0.1
Sodium hydroxide solution (0.025% pH = 10)	0.3
Salt Water (3.5% NaCl)	0.2
Isopropyl Alcohol	0.2
Hydrogen peroxide (3%)	0.2
Butyl Acetate	0.4
Sulfuric Acid (30%)	Disintegrated
Industrial Fluids	
Gasoline ISO 1817, liquid C	< 0.1
Transmission Fluid (Havoline Synthetic ATF)	< 0.1
Engine Oil (Havoline SAE 5W-30)	< 0.1
Brake Fluid (Castrol DOT-4)	< 0.1
Diesel (Chevron #2)	< 0.1
Power Steering Fluid	< 0.1
Skydrol 5	< 0.1
Hydraulic Oil	< 0.1
Diethyl glycol monomethyl ether	0.3 <
Mineral oil, heavy	0.1 <
Mineral oil, light	0.1

¹ UL flammability rating bars were printed on Form 3+/Form 3 printers with 50µm Flame Retardant Resin settings, washed in a Form Wash for (a) 10 minutes in ≥99% Isopropyl Alcohol or (b) 15 minutes in ≥99% Tripropylene glycol monomethyl ether, with a quick water rinse, and then post-cured at 70°C for 60 minutes in a Form Cure. This rating can be achieved printing in any orientation and any available layer height on a Form 3, Form 3+, Form 3B, Form 3B+, Form 3L or Form 3BL.

² FAR 25.853 Appendix F Part I (a) bars were printed on a Form 3L printer with 100µm Flame Retardant Resin settings, washed in a Form Wash L for 10 min in ≥99% Isopropyl Alcohol, and then post-cured at 70°C for 60 min in a Form Cure L.

³ Data for post-cured samples were printed on a Form3+ printer with 100 µm Flame Retardant Resin settings, washed in a Form Wash for 10 minutes in ≥99% Isopropyl Alcohol, and post-cured at 70°C for 60 minutes in a Form Cure unless specified otherwise.

⁴ 5mm thickness samples pass Smoke Tests based on a passing criteria of <200 for Ds @ 4 min in flaming mode for ASTM E 662. Users can additionally test samples for thicknesses between 3mm-5mm based on their design constraints. Samples pass Gas Toxicity at 3mm thickness.

⁵ Material properties may vary based on part geometry, print orientation, print settings, temperature, and disinfection or sterilization methods used.

⁶ Data for tensile samples were measured on Type I tensile bars printed on a Form 3+ printer with 100 µm Flame Retardant Resin settings, washed in a Form Wash for 10 minutes in ≥99% Isopropyl Alcohol, and post-cured at 70°C for 60 minutes or 80°C for 120 minutes in a Form Cure.

Clear Cast Resin

3DPrint Accurate,LowAshPatternsforInvestmentCasting
Directly inHouse

Clear Cast Resin is a resin designed for investment casting, to directly print patterns that can be invested and cast. It has an extremely low thermal expansion, low ash, and antimony free with no trace heavy metals.

Patterns for investment casting



FLCCCL01

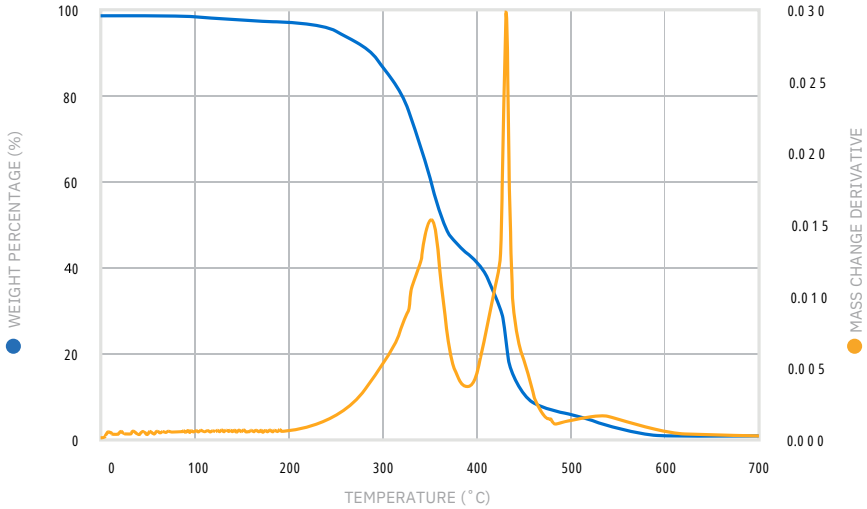
Prepared 12/08/2024

Rev. 01 12/08/2024

To the best of our knowledge the information contained herein is accurate. However, Formlabs, Inc. makes no warranty, expressed or implied, regarding the accuracy of these results to be obtained from the use thereof.

Material Properties	METRIC ¹		IMPERIAL		METHOD
	Green	Post-Cured	Green	Post-Cured	
Mechanical Properties	METRIC ¹		IMPERIAL		METHOD
Ultimate Tensile Strength	38 MPa	65 MPa	5510 psi	9380 psi	ASTM D638-14
Tensile Modulus	1.6 GPa	2.8 GPa	234 ksi	402 ksi	ASTM D638-14
Elongation at Break	12%	6%	12%	6%	ASTM D638-14
Flexural Modulus	1.3 GPa	2.2 GPa	181 psi	320 psi	ASTM D790-15
Notched Izod	16 J/m	25 J/m	0.3 ft-lb/in	0.46 ft-lb/in	ASTM D256-10
Thermal Properties	METRIC ¹		IMPERIAL		METHOD
Thermal Expansion, -30-140°C	-	94.8 µm/m/°C	-	52.6 µin/in/°F	ASTM E831-19
Heat Deflection Temp. @ 1.8 MPa	43 °C	58 °C	109 °F	137 °F	ASTM D648-16
Heat Deflection Temp. @ 0.45 MPa	50 °C	73 °C	121 °F	163 °F	ASTM D648-16
Burnout Characteristics	METRIC ¹		IMPERIAL		METHOD
Ash Content	-	<0.020%	-	<0.020%	ASTM D2584-18
Antimony ²	-	<10 ppm	-	<10 ppm	ASTM E1479-16
Detected Transition Metals (>10 ppm)	-	Al, Cu	-	Al, Cu	ASTM E1479-16
High Concentration Transition Metals (>50 ppm)	-	none	-	none	ASTM E1479-16

Clear Cast Resin TGA Trace



Castable Wax Resin

A 20% wax-filled photopolymer for reliable casting with near zero ash content and clean burnout, Castable Wax Resin accurately captures intricate features and offers the smooth surfaces stereolithography 3D printing is known for.

**FLCWPU01**

Prepared 07/05/2018

Rev. 01 07/05/2018

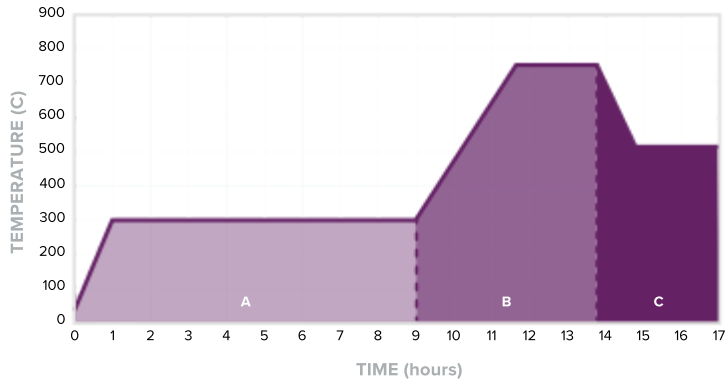
To the best of our knowledge the information contained herein is accurate. However, Formlabs, Inc. makes no warranty, expressed or implied, regarding the accuracy of these results to be obtained from the use thereof.

Material Properties	METRIC ¹	IMPERIAL ¹	METHOD
	Green ²	Green ²	
Tensile Properties	METRIC ¹	IMPERIAL ¹	METHOD
Ultimate Tensile Strength	12 MPa 220 MPa	1680 psi 32 ksi	ASTM D638-10
Tensile Modulus			ASTM D638-10
Elongation at Break		13%	ASTM D638-10
Burnout Properties	METRIC ¹	IMPERIAL ¹	METHOD
Temp @ 5% Mass Loss	249 °C	480 °C	ASTM E1131
Ash Content (TGA)		0.0 - 0.1%	ASTM E1131

STANDARD BURNOUT SCHEDULE

The Standard Burnout Schedule is designed to provide the maximum possible investment strength and complete burnout of the finest details using Certus Prestige Optima or similar investment materials. Use this schedule as a starting point and make adjustments as needed.

	PHASE	TIME	SCHEDULE °C	SCHEDULE °F
A	Insert Flasks	0 min	21 °C	70 °F
	Ramp	60 min	4.7 °C / min	8.4 °F / min
	Hold	480 min	300 °C	572 °F
B	Ramp	100 min	4.5 °C / min	8.1 °F / min
	Hold	180 min	750 °C	1382 °F
C	Ramp	60 min	- 4.0 °C / min	- 7.1 °F / min
	Casting Window	Up to 2 hours	512 °C (or desired casting temp)	954 °F (or desired casting temp)



Post-Curing Info:

No post-cure required.

¹ Material properties can vary with part geometry, print orientation, print settings, and temperature.

² Data was obtained from parts printed using Form 2, Castable 50 µm Fine Detail settings and washed without post-cure.

Alumina 4N Resin

A 99.99% purity technical ceramic with exceptional performance in extreme environments: thermally resistant, hard, abrasion resistant, mechanically strong, and chemically inert.

High voltage components

Mixing blades and pipes

Insulating housings or tubes

Foundry tools for metal casting



FLAL4N01

Prepared 31/09/2023

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Resin Properties	METRIC		IMPERIAL	METHOD
Purity (%)	99.99%			-
Particle Size	d90 < 1 micron			-
Green State Properties				
Flexural Strength ³	3.6 MPa	520 psi		ASTM D790
Flexural Modulus ³	24.5 MPa	3.5 ksi		ASTM D790
Shore D Hardness ³	70D			ASTM D2240
Color	Off-White			
Sintered State Properties	METRIC		IMPERIAL	METHOD
Physical and Mechanical Properties				
4 Point Flex Strength (XY) ^{3,5}	400 MPa	58 ksi		ASTM C1259
4 Point Flex Strength (Z) ^{3,5}	320 MPa	46 ksi		ASTM C1259
Weibull Modulus (XY) ^{3,5}	9	-		ASTM C1259
Theoretical Density ^{4,5}	3.987 g/cm ³	0.144 lbs/in3		-
Relative Density ^{3,5}	98.60%	-		ASTM C373
Compressive Strength ^{4,5}	2200 MPa	330 ksi		ASTM C773
Color	White			-
Vickers Hardness ^{4,5}	1500	-		ASTM C1259
Young's Modulus ^{4,5}	390 GPa	58,000 ksi		ASTM C1421
Fracture Toughness ^{4,5}	3-5 MPa √m	-		
Surface Roughness (R _a) ^{1,5}	0.5-3 μm	20-120 microinches Ra		
Electrical Properties	METRIC		IMPERIAL	METHOD
Electrical Resistivity ^{4,5}	> 1 x 10 ¹⁴ Ω-cm	-		ASTM D257
Dielectric Loss tan delta (tan δ), 1 MHz ^{4,5}	9x10 ⁻⁵	-		-
Permittivity ^{4,5}	9.8	-		-
Thermal properties	METRIC		IMPERIAL	METHOD
Coefficient of Thermal Expansion ^{4,5}	5 ppm/K	2.78 ppm / °F		ASTM E228
Maximum Working Temperature ^{3,5}	1500 °C	2750 °F		-
Thermal Conductivity ^{4,5}	32 W/m-K			-



To learn more about how to use Alumina 4N Resin, visit our support site.

¹ Material properties may vary based on part geometry, print orientation, print settings, and firing schedule used.

² All sintered parts were fired using a 2 oven conservative firing schedule (schedule #1)

³ Internally measured data

⁴ Literature value

⁵ Currently testing at an independent testing lab