

ENGINEERING RESIN

# Tough 2000



## Tough 2000 Resin for Rugged Prototyping

Tough 2000 Resin is the strongest and stiffest material in our functional family of Tough and Durable Resins. Choose Tough 2000 Resin for prototyping strong and sturdy parts that should not bend easily.

Strong and stiff prototypes

Sturdy jigs and fixtures

ABS-like strength and stiffness



**V1** FLTO2001

**formlabs** The Formlabs logo icon is a stylized, three-dimensional representation of a butterfly or a similar winged creature, rendered in a dark grey color.

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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 2000 Resin Material Properties Data

	METRIC <sup>1</sup>		IMPERIAL <sup>1</sup>		METHOD
	Green <sup>2</sup>	Post-Cured <sup>3</sup>	Green <sup>2</sup>	Post-Cured <sup>3</sup>	
<b>Mechanical Properties</b>					
Ultimate Tensile Strength	29 MPa	46 MPa	4206 psi	6671 psi	ASTM D 638-14
Tensile Modulus	1.2 GPa	2.2 GPa	174 ksi	329 ksi	ASTM D 638-14
Elongation at Break	74 %	48 %	74 %	48 %	ASTM D 638-14
<b>Flexural Properties</b>					
Flexural Strength	17 MPa	65 MPa	2465 psi	9427 psi	ASTM D 790-15
Flexural Modulus	0.45 GPa	1.9 GPa	65 ksi	275 ksi	ASTM D 790-15
<b>Impact Properties</b>					
Notched IZOD	79 J/m	40 J/m	1.5 ft-lbf/in	0.75 ft-lbf/in	ASTM D256-10
Unnotched IZOD	208 J/m	715 J/m	3.9 ft-lbf/in	13 ft-lbf/in	ASTM D4812-11
<b>Thermal Properties</b>					
Heat Deflection Temp. @ 1.8 MPa	42 °C	53 °C	108 °F	127 °F	ASTM D 648-16
Heat Deflection Temp. @ 0.45 MPa	48 °C	63 °C	118 °F	145 °F	ASTM D 648-16
Coefficient of Thermal Expansion	107 µm/m/°C	91 µm/m/°C	59 µin/in/°F	50 µin/in/°F	ASTM E 831-13

<sup>1</sup>Material properties can vary with part geometry, print orientation, print settings, and temperature.

<sup>2</sup>Data was obtained from green parts, printed using Form 2, 100 µm, Tough settings, washed and air dried without post cure.

<sup>3</sup>Data was obtained from parts printed using Form 2, 100 µm, Tough 2000 settings, and post-cured with a Form Cure for 120 minutes at 80 °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:

Solvent	24 Hour Weight Gain (%)	Solvent	24 Hour Weight Gain (%)
Acetic Acid, 5 %	0.71	Hydrogen Peroxide (3 %)	0.63
Acetone	18.82	Isooctane	0.03
Isopropyl Alcohol	3.7	Mineral Oil, light	0.13
Bleach, ~5 % NaOCl	0.56	Mineral Oil, heavy	0.17
Butyl Acetate	6.19	Salt Water (3.5 % NaCl)	0.56
Diesel	0.06	Sodium hydroxide (0.025 %, pH = 10)	0.61
Diethyl glycol monomethyl ether	5.32	Water	0.61
Hydraulic Oil	0.08	Xylene	4.1
Skydrol 5	0.87	Strong Acid (HCl Conc)	3.01