formlabs

ENGINEERING RESIN

Tough 1500 Resin

Resin for Resilient Prototyping

Tough 1500 Resin is the most resilient material in our functional family of Tough and Durable Resins. This resin produces stiff and pliable parts that bend and spring back quickly under cyclic loading.

Springy prototypes and assemblies

Polypropylene-like strength and stiffness

Snap fit and press fit connectors

Certified biocompatible for extended skin-contact

V1 **FLTO1501**

V1.1 **FLTO1511**

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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.

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]	
Mechanical Properties	METRIC [1]			IMPERIAL [1]			METHOD
Ultimate Tensile Strength	25 MPa	30 MPa	35 MPa	3626 psi	4351 psi	5076 psi	ASTM D638-14
Tensile Modulus	960 MPa	1260 MPa	1440 MPa	139 ksi	183 ksi	209 ksi	ASTM D638-14
Elongation at Break	85%	64%	54%	85%	64%	54%	ASTM D638-14
Flexural Properties	METRIC [1]			IMPERIAL [1]			METHOD
Flexural Strength	28 MPa	44 MPa	51 MPa	4061 psi	6382 psi	7297 psi	ASTM D790-17
Flexural Modulus	720 MPa	1130 MPa	1320 MPa	104 ksi	164 ksi	191 ksi	ASTM D790-17
Impact Properties	METRIC [1]			IMPERIAL [1]			METHOD
Notched Izod	72 J/m	69 J/m	61 J/m	1.30 ft-lb/in	1.30 ft-lb/in	1.14 ft-lb/in	ASTM D256-10
Unnotched Izod	902 J/m	Not Tested	1387 J/m	17 ft-lb/in	Not Tested	26 ft-lb/in	ASTM D4812-11
Gardner at 1/32" (0.97 mm) thickness	Not Tested	Not Tested	2.5 J	Not Tested	Not Tested	22 in-lb	ASTM D5420-21
Fracture Properties	METRIC [1]			IMPERIAL [1]			METHOD
Maximum Stress Intensity Factor (Kmax)	Not Tested	Not Tested	1.23 $MPa \cdot m^{1/2}$	Not Tested	Not Tested	1120 $psi \cdot in^{1/2}$	ASTM D5045-14
Work of Fracture (W_f)	Not Tested	Not Tested	102 J/m^2	Not Tested	Not Tested	7.0 $ft\text{-}lb/ft^2$	ASTM D5045-14
Thermal Properties	METRIC [1]			IMPERIAL [1]			METHOD
Heat Deflection Temp. @ 1.8 MPa	34 °C	39 °C	43 °C	93 °F	102 °F	109 °F	ASTM D648-16
Heat Deflection Temp. @ 0.45 MPa	42 °C	45 °C	48 °C	108 °F	113 °F	118 °F	ASTM D648-16
Thermal Expansion (0-150 °C)	114 µm/m/°C	Not Tested	97 µm/m/°C	63 µin/in/°F	Not Tested	54 µin/in/°F	ASTM E831-13

BIOCOMPATABILITY

Tough 1500 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 [5,6]
ISO 10993-5	Not Cytotoxic
ISO 10993-10	Not an Irritant
ISO 10993-10	Not a Sensitizer

[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 settings, without additional treatments.

[3] Data was obtained from parts printed using Form 4, 100 µm, Tough 1500 settings and post-cured with a Form Cure (2nd Generation) for 12 minutes at Room Temperature.

[4] Data was obtained from parts printed using Form 4, 100 µm, Tough 1500 settings and post-cured with a Form Cure (2nd Generation) for 12 minutes at 70 °C.

[5] SO 10993 standard testing samples were printed on a Form 3 with 100um Tough 1500 Resin settings, washed in a Form Wash for 20 minutes in ≥99% Isopropyl Alcohol, dried for at least 30 minutes and post-cured at 70 °C for 60 minutes in a Form Cure.

[6] Tough 1500 Resin was tested at NAMSA World Headquarters, OH, USA

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%)	0.7	Mineral Oil (Heavy)	< 0.1
Acetone	19.0	Mineral Oil (Light)	< 0.1
Bleach (5% NaOCl)	0.6	Salt water (3.5% NaCl)	0.7
Butyl Acetate	5.0	Skydrol 5	0.5
Diesel	0.1	Sodium Hydroxide Solution (0.025% pH = 10)	0.7
Diethyl Glycol Monomethyl Ether	5.3	Strong Acid (HCl Conc)	4.4
Hydraulic Oil	0.2	TPM	0.6
Hydrogen Peroxide (3%)	0.7	Water	0.7
Isooctane	< 0.1	Xylene	3.2
Isopropyl Alcohol	3.2		