



Materials Data Sheet

Photopolymer Resin for Form 1+ and Form 2

FORMLABS MATERIAL PROPERTIES

Prepared: 10/18/2016

Revised: 01/27/2017

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.

CLEAR FLGPCL02¹

	METRIC ²		IMPERIAL ²		METHOD
	Green ³	Postcured ⁴	Green ³	Postcured ⁴	
Mechanical Properties					
Tensile Strength at Yield	38 MPa	65 MPa	5510 psi	9380 psi	ASTM D 638-10
Young's Modulus	1.6 GPa	2.8 GPa	234 ksi	402 ksi	ASTM D 638-10
Elongation at Failure	12 %	6.2 %	12 %	6.2 %	ASTM D 638-10
Flexural Modulus	1.25 GPa	2.2 GPa	181 ksi	320 ksi	ASTM C 790-10
Notched IZOD	16 J/m	25 J/m	0.3 ft-lbf/in	0.46 ft-lbf/in	ASTM D 256-10
Thermal Properties					
Heat deflection temp. @ 264 psi	42.7 °C	58.4 °C	108.9 °F	137.1 °F	ASTM D 648-07
Heat deflection temp. @ 66 psi	49.7 °C	73.1 °C	121.5 °F	163.6 °F	ASTM D 648-07

NOTES:

¹Clear material properties are representative of all Standard Resins: Clear, White, Black and Grey.

²Material properties can vary with part geometry, print orientation, print settings and temperature.

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

⁴Data refers to post-cured properties obtained after exposing green parts to 1.25 mW/cm² of 405 nm light at 60 °C for 1 hour.

HIGH TEMP FLHTAM01

	METRIC ¹		IMPERIAL ¹		METHOD
	Green ²	Post-Cured ³	Green ²	Post-Cured ³	
Mechanical Properties					
Tensile Strength at Break	33 MPa	51.1 MPa	4790 psi	7410 psi	ASTM D 638-14
Young's Modulus	1.5 GPa	3.6 GPa	222 ksi	525 ksi	ASTM D 638-14
Elongation at Break	9 %	2 %	9 %	2 %	ASTM D 638-14
Flexural Strength at Break	41.2 MPa	106.9 MPa	5980 psi	15500 psi	ASTM D 790-15
Flexural Modulus	1.1 GPa	3.3 GPa	158 ksi	478 ksi	ASTM D 790-15
Notched IZOD	12.3 J/m	14 J/m	0.23 ft-lbf/in	0.26 ft-lbf/in	ASTM D 256-10
Water Absorption	N/A	0.21 %	N/A	0.21 %	ASTM D 570-98
Thermal Properties					
Heat Deflection Temp. @ 1.8 MPa	42.3 °C	130 °C	108.1 °F	266 °F	ASTM D 648-16
Heat Deflection Temp. @ 0.45 MPa	55.9 °C	289 °C	132.6 °F	552.2 °F	ASTM D 648-16
Thermal Expansion (0 – 150 °C)	120.9 µm/m/°C	87.5 µm/m/°C	67.2 µin/in/°F	48.6 µin/in/°F	ASTM E 831-13

NOTES:

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

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

³Data refers to post-cured properties obtained after exposing green parts with 290 J/cm² of fluorescent bulb UV light, centered at 365 nm.

TOUGH FLTOTL03

	METRIC ¹		IMPERIAL ¹		METHOD
	Green ²	Post-Cured ³	Green ²	Post-Cured ³	
Mechanical Properties					
Tensile Strength	34.7 MPa	55.7 MPa	5040 psi	8080 psi	ASTM D 638-14
Young's Modulus	1.7 GPa	2.7 GPa	239 ksi	387 ksi	ASTM D 638-14
Elongation at Break	42 %	24 %	42 %	24 %	ASTM D 638-14
Flexural Strength at 5% Strain	20.8 MPa	60.6 MPa	3020 psi	8790 psi	ASTM D 790-15
Flexural Modulus	0.6 GPa	1.6 GPa	90.3 ksi	241 ksi	ASTM D 790-15
Notched IZOD	32.6 J/m	38 J/m	0.61 ft-lbf/in	0.71 ft-lbf/in	ASTM D 256-10
Thermal Properties					
Heat Deflection Temp. @ 1.8 MPa	32.8 °C	45.9 °C	91.1 °F	114.6 °F	ASTM D 648-16
Heat Deflection Temp. @ 0.45 MPa	40.4 °C	48.5 °C	104.7 °F	119.3 °F	ASTM D 648-16
Thermal Expansion (23 – 50 °C)	159.7 µm/m/°C	119.4 µm/m/°C	88.7 µm/m/°F	66.3 µm/m/°F	ASTM E 831-13

NOTES:

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

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

³Data refers to post-cured properties obtained after exposing green parts with 2.5 mW/cm² of 405 nm LED light for 120 minutes at 60°C.

DURABLE FLDUCL01

	METRIC ¹		IMPERIAL ¹		METHOD
	Green ²	Post-Cured ³	Green ²	Post-Cured ³	
Tensile Properties					
Tensile Strength at Yield	18.6 MPa	31.8 MPa	2.7 ksi	4.61 ksi	ASTM D 638-10
Tensile Modulus	0.45 GPa	1.26 GPa	65.7 ksi	183 ksi	ASTM D 638-10
Elongation	67 %	49 %	67 %	49 %	ASTM D 638-10
Flexural Properties					
Flexural Stress at 5% Strain	4.06 MPa	27.2 MPa	0.59 ksi	3.95 ksi	ASTM D 790-10, Procedure A
Flexural Modulus	0.16 GPa	0.82 GPa	23.4 ksi	119 ksi	ASTM D 790-10, Procedure A
Impact Properties					
IZOD Impact Strength	130.8 J/m	109 J/m	2.46 ft-lbf/in	2.05 ft-lbf/in	ASTM D 256-10, Test Method A
Temperature Properties					
Heat Deflection Temp. @ 0.45 MPa	< 30 °C	43.3 °C	< 86 °F	110 °F	ASTM D 648-07, Method B
Thermal Expansion from 23 to 50°C	117.0 µm/m/°C	145.1 µm/m/°C	65.0 µin/in/°F	80.6 µin/in/°F	ASTM E831-14

NOTES:

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

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

³Data refers to post-cured properties obtained after exposing green parts with 2.5 mW/cm² of 405 nm LED light for 120 minutes at 60°C.

FLEXIBLE FLFLGR02

	METRIC ¹		IMPERIAL ¹		METHOD
	Green	Postcured ²	Green	Postcured ²	
Mechanical Properties					
Tensile Strength ³	3.3 – 3.4 MPa	7.7 – 8.5 MPa	483 – 494 psi	1110 – 1230 psi	ASTM D 412-06 (A)
Elongation at Failure ³	60 %	75 – 85 %	60 %	75 – 85 %	ASTM D 412-06 (A)
Compression Set ⁴	0.40 %	0.40 %	0.40 %	0.40 %	ASTM D 395-03 (B)
Tear Strength ⁵	9.5 – 9.6 kN/m	13.3 – 14.1 kN/m	54 – 55 lbf/in	76 – 80 lbf/in	ASTM D 624-00
Shore Hardness	70 – 75 A	80 – 85 A	70 – 75 A	80 – 85 A	ASTM 2240
Thermal Properties					
Vicat Softening Point ⁶	231 °C	230 °C	448 °F	446 °F	ASTM D 1525-09

NOTES:

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

²Data was obtained from parts printed using Form 2, 100 um, Flexible settings and post-cured with 290 J/cm² of fluorescent bulb UV light, centered at 365 nm.

³Tensile testing was performed after 3+ hours at 23 °C, using a Die C dumbbell and 20 in/min cross head speed.

⁴Compression testing was performed at 23 °C after aging at 23 °C for 22 hours.

⁵Tear testing was performed after 3+ hours at 23 °C, using a Die C tear specimen and a 20 in/min cross head speed.

⁶Thermal testing was performed after 40+ hours with a 10 N loading at 50 °C/hour. Cracks formed in samples during testing.

DENTAL SG FLDGOR01

	METRIC		METHOD
	Postcured		
Flexural Properties			
Flexural Strength	≥ 50 MPa		ISO 20795-1:2013
Flexural Modulus	≥ 1500 Mpa		ISO 20795-1:2013
Hardness Properties			
Hardness Shore D	≥ 80D		per ISO 868:2003
Impact Properties			
Charpy Impact Strength Unnotched	12 – 14 kg/m ²		ISO 179:2010

Dental SG is tested at NAMSA, Chasse sur Rhône in France, and is certified biocompatible per EN-ISO 10993-1:2009/AC:2010:

- Non-mutagenic.
- Non-cytotoxic.
- Not induce any erythema or edema reactions.
- Not a sensitizer.
- Not cause systemic toxicity.

The product is in compliance with ISO Standards:

- EN-ISO 20795-1:2013 (Dentistry – Base Polymers – Part 1: Denture Base Polymers)
- EN-ISO 7405:2009/A1:2013 (Dentistry – Evaluation of biocompatibility of medical devices used in dentistry)
- EN-ISO 10993-1:2009/AC:2010 (Biological evaluation of medical devices – Part 1 – Evaluation and testing)

NOTES:

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

²Data refers to post-cured properties obtained after exposing green parts to 108 watts each of Blue UV-A (315 – 400 nm) and UV-Blue (400 – 550 nm) light, in a heated environment at 60 °C (140 °F), with six (6) 18W/71 lamps (Dulux L Blue) and six (6) 18W/78 lamps (Dulux blue UV-A).

CASTABLE FLCABL02

	METRIC	IMPERIAL	METHOD
Mechanical Properties¹			
Tensile Strength at Break	11.6 MPa	1680 psi	ASTM D 638-10
Young's Modulus	220 MPa	32 ksi	ASTM D 638-10
Elongation at Failure	13 %	13 %	ASTM D 638-10

NOTES:

¹Data was obtained from parts printed using Form 2, Castable 50 µm Fine Detail settings and post-cured with 2.5 mW/cm² of fluorescent bulb UV light, centered at 405 nm