formlabs

# PU Rigid 650

## For Impact Resistant and Semi-Stiff Polyurethane Parts

PU Rigid 650 Resin is a tough and pliable polyurethane material that can withstand extreme impacts while maintaining true shape long-term.

**Impact-resistant components**

**Pliable mechanical connectors**

**Shock-absorbing bumpers and dampeners**

**Noise-dampening components**

V1 **FLPU6501** *** May not be available in all regions**

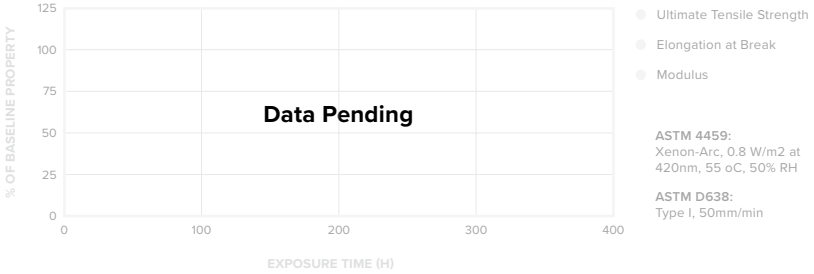
**Prepared** 05 . 03 . 2022

**Rev. 01** 05 . 03 . 2022

MATERIAL PROPERTIES DATA **PU Rigid 650 Resin**

| | METRIC [1] | IMPERIAL [1] | METHOD |
|---|---|---|---|
| | Post-Cured [2] | Post-Cured [2] | |
| **Tensile Properties** | | | |
| Ultimate Tensile Strength | 34 ± 3.4 MPa | 5 ± 0.5 ksi | ASTM D638 |
| Young's Modulus | 0.67 ± 0.06 GPa | 97 ± 9 ksi | ASTM D638 |
| Elongation at Break | 170 ± 17 % | 170 ± 17 % | ASTM D638 |
| **Flexural Properties** | | | |
| Flexural Strength | 22 ± 1.1 MPa | 3.2 ± 0.2 ksi | ASTM D 790-15 |
| Flexural Modulus | 0.57 ± 0.03 GPa | 83 ± 4 ksi | ASTM D 790-15 |
| Ross Flexing Fatigue (unnotched) | > 50,000 cycles (PASS-no crack propagation) | | ASTM D 1052 (-10 °C) |
| Ross Flexing Fatigue (unnotched) | > 50,000 cycles (PASS-no crack propagation) | | ASTM D 1052 (23 °C) |
| **Impact Properties** | | | |
| Notched Izod | 375 J/m | 7.0 ft-lbs/in | ASTM D 256-10 |
| Charpy Impact Test (Notched) | 44 $kJ/m^2$ | 21 $ft\text{-}lbs/in^2$ | ISO 179-1:2010(E) |
| Tabor Abrasion | 101 $mm^3$ | 6.2 x 10-3 $in^3$ | ISO 4649 (40rpm, 10N load) |
| **Physical Properties** | | | |
| Hardness | 64D | | ASTM D 2240 |
| Density (solid) | 1.16 $g/cm^3$ | 72.42 $lb/ft^3$ | ASTM D 792-20 |
| Viscosity (@ 25 °C) | 1070 cP | | |
| Viscosity (@ 35 °C) | 519 cP | | |
| **Thermal Properties** | | | |
| Heat Deflection Temp. @ 1.8 MPa | 59 °C | 138 °F | ASTM D 648-16 |
| Heat Deflection Temp. @ 0.45 MPa | 82 °C | 179 °F | ASTM D 648-16 |
| Thermal Expansion | 130.4 µm/m/°C | 72.4 µin/in/°F | ASTM E 813-13 |
| **Electrical Properties** | | | |
| Dielectric Strength | 1.8 x $10^7$ V/m | 460 V/mil | ASTM D149-20 |
| Dielectric Constant | 4.3 | | ASTM D 150, 0.5 MHz |
| Dielectric Constant | 4.7 | | ASTM D 150, 1.0 MHz |
| Dissipation Factor | 0.088 | | ASTM D 150, 0.5 MHz |
| Dissipation Factor | 0.088 | | ASTM D 150, 1.0 MHz |
| Volume resistivity | 4.7x $10^{11}$ ohm-cm | 1.9 x $10^{11}$ ohm-in | ASTM D257-14 |
| **Flammability Properties** | | | |
| Flammability rating | HB | | UL 94 |
| Smoke Density | (D s 1.5) = 15 (PASS)<br>(D s 4.0) = 262 (FAIL) | | ASTM E662-21 |
| **Automotive Specific Testing** | | | |
| Volatile Organic Compounds | 444 µg/g | 0.07 oz/lb | VOC VDA 278 |
| Fogging | 10.7 mg | 3.8 x $10^{-4}$ oz | DIN 75201, Method B |

### Accelerated Aging




PU Rigid 650 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 [3, 4] |
|---|---|
| EN ISO 10993-5 | Not cytotoxic |
| EN ISO 10993-10 | Not an irritant |
| EN ISO 10993-10 | Not a sensitizer |

## 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% | 0.4 | Isopropyl Alcohol | 1.3 |
| Acetone | 8.9 | Castor Oil | < 0.1 |
| Bleach ~5% NaOCl | < 0.1 | Mineral oil, light | < 0.1 |
| Butyl Acetate | 2.6 | Propylene Glycol Diacetate | 0.7 |
| Dichloromethane | 116.1 | Salt Water (3.5% NaCl) | 0.3 |
| Diesel Fuel | < 0.1 | Skydrol 500B-4 | 0.1 |
| Diethyl glycol monomethyl ether | 2.7 | Sodium hydroxide solution (0.025% pH = 10) | 0.2 |
| Gasoline | < 0.1 | Strong Acid (HCl Conc) | -3.0 |
| Hexane | < 0.1 | Water | 0.3 |
| Hydraulic Oil | < 0.1 | Xylene | 2.0 |
| Hydrogen peroxide (3%) | 0.2 | | |

[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 2 printer with 100 µm PU Rigid 650 Resin settings, washed in a Form Wash for 2 minutes in ≥99% PGDA, and post-cured.

[3] ISO 10993 standard testing samples were printed on a Form 3 with 100um PU Rigid 650 Resin settings, washed in PGDA for 5 minutes, dried for at least 24 hours and cured at 46°C at 70% RH for 3 day in an oven.

[4] PU Rigid 650 Resin was tested at NAMSA World Headquarters, OH, USA.