

Tough 60C White

White plastic for long-term use parts with a good combination of impact strength, elongation, and tensile strength.

Versatile, biocompatible-capable production-grade white material with good impact strength, elongation, and tensile strength.

Tough 60C White provides long-term environmental stability and long-lasting white color with an injection molded-like surface quality.

This material is recommended for high mechanical load-bearing batch production medical parts that remain functional and stable for years.

This resin features a 65°C heat deflection temperature and 23% elongation at break, and is excellent for brackets, snaps, and clips due to a 7.1% elongation at yield. Fast print speeds and simplified postprocessing speeds enable exceptional throughput.



Applications

- ▶ Clinical trials and medical devices such as tools, handles, and small plastic parts
- ▶ Load-bearing parts such as handles, cranks, knobs, and levers
- ▶ Structural parts like brackets, snap-fits, and custom fasteners
- ▶ Small parts requiring detail and accuracy in consumer products, wearable devices, and general use
- ▶ Functional prototyping and biocompatible end-user parts

Benefits

- ▶ Long-term use parts for indoor and outdoor applications
- ▶ No secondary thermal cure required
- ▶ Clean, long-lasting bright white color
- ▶ Excellent surface quality, accuracy & repeatability
- ▶ Autoclavable

Features

- ▶ Long-term indoor and outdoor environmental stability of mechanical properties and color; tested out to 8 and 1.5 years (respectively) per ASTM methods
- ▶ Biocompatible-capable per ISO10993-5 and ISO10993-10*
- ▶ 65°C HDT at 0.455MPa
- ▶ 23% elongation at break
- ▶ 7.1% elongation at yield
- ▶ 34 J/m notched impact strength
- ▶ 1500 MPa tensile modulus
- ▶ UL94 HB flammability
- ▶ Sterilisation through Autoclave



*BIOCOMPATIBILITY STATEMENT

Tough 60C White test coupons printed and processed according to the post processing instructions below were provided to an external biological testing laboratory for evaluation in accordance with ISO 10993-5 and ISO 10993-10, Biological evaluation of medical devices - Part 5: Tests for in vitro cytotoxicity. The test results indicate that Tough 60C White has passed the requirements for biocompatibility according to the above test.

It is the responsibility of each customer to determine that its use of Tough 60C White material is safe, lawful and technically suitable to the customer's intended applications. Customers should conduct their own testing to ensure that this is the case. Because of possible changes in the law and in regulations, as well as possible changes in these materials, Prototype Projects cannot guarantee that the status of these materials will remain unchanged or that it will qualify as biocompatible in any particular use. Therefore, Prototype Projects recommends that customers continuing to use these materials verify their status on a periodic basis.

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Material properties - liquid material

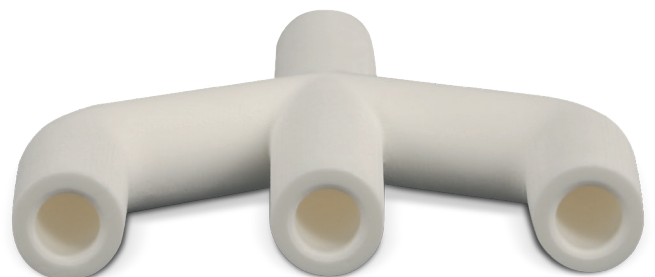
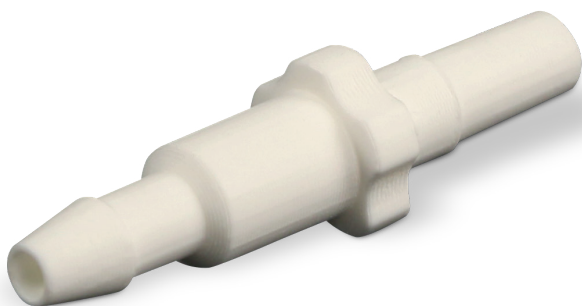
The full suite of mechanical properties is given per ASTM and ISO standards where applicable. All parts are conditioned per ASTM recommended standards for a minimum of 40 hours at 23 °C, 50% RH. Material properties include physical and mechanical properties, as well as thermal, flammability, and electrical (dielectric strength, dielectric constant, dissipation factor, and volume resistivity).

LIQUID MATERIAL			
MEASUREMENT	CONDITION	METRIC	ENGLISH
Viscosity	Brookfield Viscometer @ 25 °C (77 °F)	1800 cPs	4354 lb/ft h
Colour		White	
Liquid Density	Kruss K11 Force Tensiometer @ 25 °C (77 °F)	1.15 g/cm ³	0.04 lb/in ³

Isotropic properties

DLP technology prints parts that are generally isotropic in mechanical properties meaning the parts printed along either the XYZ axis will give similar results. Parts do not need to be oriented to get the highest mechanical properties, further improving the degree of freedom for part orientation for mechanical properties.

SOLID MATERIAL					
METRIC	METHOD	ZY	XZ	XY	Z45
Tensile Strength Ultimate	ASTM D638 Type IV	35 MPa	38 MPa	38 MPa	35 MPa
Tensile Strength at Yield	ASTM D638 Type IV	35 MPa	38 MPa	38 MPa	35 MPa
Tensile Modulus	ASTM D638 Type IV	1500 MPa	1500 MPa	1500 MPa	1500 MPa
Elongation at Break	ASTM D638 Type IV	23%	30%	34%	20%
Elongation at Yield	ASTM D638 Type IV	7.1 %	7.2 %	8.2 %	10.1 %
Flex Strength	ASTM D790	52 MPa	44 MPa	46 MPa	44 MPa
Flex Modulus	ASTM D790	1500 MPa	1200 MPa	1300 MPa	1200 MPa
Izod Notched Impact	ASTM D256	34 J/m	41 J/m	41 J/m	26 J/m
Shore Hardness	ASTM D2240	79 D	N/A	N/A	N/A



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Material properties - solid material

SOLID MATERIAL			
MEASUREMENT	CONDITION	METRIC	ENGLISH
Solid Density (g/cm ³ lb/in ³)	ASTM D792	1.23 g/cm ³	0.044 lb/in ³
Water Absorption (24 hour)	ASTM D570	0.61%	0.61%
Tensile Strength, Ultimate (MPa PSI)	ASTM D638	35 MPa	5100 psi
Tensile Strength, at Yield (MPa PSI)	ASTM D638	35 MPa	5100 psi
Tensile Modulus (MPa KSI)	ASTM D638	1500 MPa	220 ksi
Elongation at Break	ASTM D638	23%	23%
Elongation at Yield	ASTM D638	7.1%	7.1%
Flexural Strength (MPa PSI)	ASTM D790	52 MPa	7500 psi
Tensile Modulus (MPa KSI)	ASTM D790	1500 MPa	220 ksi
Izod Notched Impact Strength (J/m Ft-lbs/in)	ASTM D256	34 J/m	0.6 ft-lb/in
Izod Unnotched Impact Strength (J/m Ft-lbs/in)	ASTM D4812	90 J/m	2 ft-lb/in
Shore Hardness	ASTM D2240	79 D	79 D
Tg (DMA, E")	ASTM E1640 (E" at 1C/min)	50 °C	123 °F
Heat Deflection Temperature @ 0.455 MPa (66 PSI)	ASTM D648	65 °C	149 °F
@ 1.82 MPa (264 PSI)	ASTM D648	48 °C	119 °F
Coefficient of Thermal Expansion (CTE) (ppm/°C ppm/°F)	ASTM E831	95 ppm/°C	55 ppm/°F
< Tg	ASTM E831	171 ppm/°C	95 ppm/°F
> Tg			
UL Flammability	UL94	HB	HB
Dielectric Strength (KV/mm) @ 3.0mm thickness	ASTM D149	13	
Dielectric Constant @ 1 MHz	ASTM D150	3.79	
Dissipation Factor @ 1 MHz	ASTM D150	0.033	
Volume Resistivity (ohm-cm)	ASTM D257	2.45x10 ¹⁵	



Warranty/Disclaimer: The performance characteristics of these products may vary according to product application, operating conditions, material combined with, or with end use. Prototype Projects makes no warranties of any type, express or implied, including, but not limited to, the warranties of merchantability or fitness for a particular use.