SELECTIVE LASER SINTERING

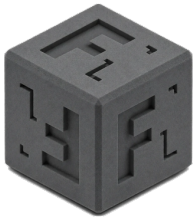
TPU 90A

Skin-Safe SLS Elastomer for Wearables, Grips and Protective Covers

TPU 90A is the flexible Formlabs SLS powder: 90 Shore A, 310% elongation at break along the build plane and high tear strength, so straps, clips, liners and covers flex into place and spring back. Formlabs certifies the powder under ISO 10993-1 for long-term contact with intact skin when parts are finished to its process, and parts come in grey or black with a soft, even matte finish.

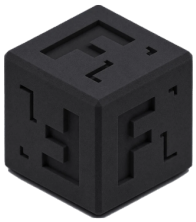


SURFACE FINISHES



Standard Finish Grey

Parts are depowdered and bead blasted to an even, fine-textured matte finish in grey. Detail stays clear and well defined, and the durable surface suits functional and end-use parts.



Deep Color Dye Enhanced Finish

DyeMansion deep colour dyeing gives a rich, uniform colour across the entire part, even on complex geometries and intricate designs. The dye also improves scratch resistance, making parts more durable in handling and use.

BUILD VOLUME	LEAD TIME	LAYER HEIGHT	TOLERANCE
165 × 165 × 300 mm	**2-4 business days**	**0.11 mm**	**±0.3% (min ±0.3 mm)**

MECHANICAL PROPERTIES

Tensile strength, elongation at break and the stress at 50% and 100% stretch show how far a part extends and how firmly it pulls back. TPU 90A stretches much further along the build plane than across its layers, so straps, bands and clips that must stretch furthest are best oriented flat in the build.

Tear strength shows how well a nicked or notched edge resists splitting, which matters for thin lips, clip arms and strap slots. Compression set shows how much of a squeeze a part keeps after the load is removed, so lower is better: recovery is good at room temperature and drops at 70 °C, so cushions that stay compressed in hot places should be tested in service. Abrasion is the volume lost on a rotating abrasive drum, where a lower value means better wear resistance.

PROPERTY	VALUE	TEST STANDARD
Shore A Hardness	**90**	ASTM D2240-15 (2021)
Ultimate Tensile Strength (X/Y)	**8.7 MPa**	ASTM D412-16, Method A
Ultimate Tensile Strength (Z)	**7.2 MPa**	ASTM D412-16, Method A
Elongation at Break (X/Y)	**310 %**	ASTM D412-16, Method A

Elongation at Break (Z)	**110 %**	ASTM D412-16, Method A
Stress at 50% Elongation (X/Y)	**6.1 MPa**	ASTM D412-16, Method A
Stress at 50% Elongation (Z)	**5.9 MPa**	ASTM D412-16, Method A
Stress at 100% Elongation (X/Y)	**7.2 MPa**	ASTM D412-16, Method A
Stress at 100% Elongation (Z)	**7.0 MPa**	ASTM D412-16, Method A
Tear Strength (X/Y)	**66 kN/m**	ASTM D624-00 (2020)
Tear Strength (Z)	**39 kN/m**	ASTM D624-00 (2020)
Compression Set B (23 °C)	**20.5 %**	ASTM D395-18, Method B
Compression Set B (70 °C, 22 h)	**59.9 %**	ASTM D395-18, Method B
Abrasion Resistance, Volume Loss	**122 mm³**	ISO 4649 (40 rpm, 10 N)

THERMAL PROPERTIES

The Vicat softening temperature marks where a part under a small load begins to soften. TPU 90A suits parts that stay well below this point, such as parts worn on the body or used at room temperature; keep it away from hot surfaces and out of processes, such as pressure dyeing, that run above this point.

PROPERTY	VALUE	TEST STANDARD
Vicat Softening Temperature	**94.3 °C**	ASTM D1525
Melting Range (powder)	**120–150 °C**	Formlabs SDS

PHYSICAL PROPERTIES

Part density shows how light parts are for their size, and water absorption shows how little moisture printed parts take up when immersed, so fit and feel stay stable in humid use and after washing. Moisture content, melting range and bulk density describe the powder before printing, not the finished part.

PROPERTY	VALUE	TEST STANDARD
Part Density (sintered)	**1.14 g/cm³**	Formlabs in-house method
Water Absorption	**0.89 %**	ASTM D570
Moisture Content (powder)	**0.19 %**	ISO 15512, Method D
Bulk Density (powder)	**0.3–0.6 g/cm³**	Formlabs SDS
Colour (as printed)	**Grey or black**	—

CHEMICAL PROPERTIES

The table lists the weight a printed 1 cm cube gains after 24 hours in each fluid. Small gains mean the part keeps its size and feel; large gains mean it swells. Water, salt water, bleach, dilute alkali and gasoline leave almost no change; oils, diesel, hydraulic oil, hydrogen peroxide and dilute acetic acid add a little; isopropyl alcohol, Skydrol and tripropylene glycol monomethyl ether swell it moderately; acetone, xylene, butyl acetate and diethylene glycol monomethyl ether swell it heavily; and concentrated hydrochloric acid removes material, shown as a weight loss.

Clean parts with water rather than alcohol or solvents, and confirm long fluid exposure with application-specific testing before production release.

CHEMICAL	24 H WEIGHT GAIN
Acetic acid 5%	**1.3%**
Acetone	**28.6%**
Bleach (~5% NaOCl)	**0.8%**
Butyl acetate	**16.5%**
Diesel fuel	**2.0%**
Diethylene glycol monomethyl ether	**14.4%**
Hydraulic oil	**2.8%**
Hydrogen peroxide 3%	**1.0%**
Isooctane (gasoline)	**0.7%**
Isopropyl alcohol	**4.8%**
Mineral oil (light)	**2.3%**
Mineral oil (heavy)	**2.1%**
Salt water (3.5% NaCl)	**0.9%**
Skydrol 5	**6.5%**
Sodium hydroxide 0.025% (pH 10)	**0.9%**
Strong acid (HCl, concentrated)	**-5.2% (weight loss)**
Tripropylene glycol monomethyl ether	**9.9%**
Water	**0.9%**
Xylene	**20.8%**

BIOCOMPATIBILITY AND COMPLIANCE

Formlabs certifies that TPU 90A parts, printed and post-processed to its instructions (cooled in the printer, depowdered, blasted with glass media, washed with water and blown clean), meet ISO 10993-1 for long-term (more than 30 days) contact with intact skin and limited (up to 24 hours) contact with mucosal membranes. Printed samples were non-cytotoxic, non-irritant and non-sensitizing in testing at NAMSA.

The device maker validates the final part for its intended use. Formlabs states no sterilization method, USP Class VI rating, food contact approval, flammability rating, or RoHS or REACH declaration for TPU 90A Powder.

STANDARD	STATUS
ISO 10993-1 (Skin and mucosal membrane contact) Parts printed and post-processed to the Formlabs instructions are biologically safe for long-term (more than 30 days) intact skin contact and limited (up to 24 hours) mucosal membrane contact (Formlabs Biocompatibility Certification, 7 March 2023)	Formlabs certificate

ISO 10993-5 (Cytotoxicity) Non-cytotoxic, ISO elution method, tested at NAMSA	Formlabs tested
ISO 10993-23 (Irritation) Non-irritant, intracutaneous reactivity study, tested at NAMSA	Formlabs tested
ISO 10993-10 (Sensitization) Non-sensitizer, guinea pig maximization study, tested at NAMSA	Formlabs tested

MANUFACTURING

Largest part	**161 × 161 × 295 mm**