FLXR ENGINEERING

PEN Filament

Technical Data Sheet
3D Printing Filament



GENERAL INFORMATION

PEN (*Polyethylene Naphthalate*) is a high-purity FDM 3D-printing filament for components used in medical devices, biotech and chemical applications. These include parts that contact cells, blood, active pharmaceutical ingredients (APIs) and food.

To support your validation work, 3D-printed PEN specimens have passed USP Class VI and ISO 10993 biological safety tests.

PEN is easy-to-print on desktop FDM 3D printers, so you spend less time tuning print settings.
Printed parts are also compatible with common sterilization methods.

This grade uses high-molecular-weight PEN with zero additives. Low-molecular-weight polymers and catalyst residues are removed during manufacturing, resulting in a low extractables and leachables (E&L) potential material.

For fluid handling, as-printed PEN offers better water wettability and lower protein adsorption than PC-ISO and BioMed Clear. Water spreads more easily across its surface, and less protein sticks to it, helping reduce protein loss during use.

STANDARDS & COMPLIANCE	
3D-printed	USP <88> Class VI, USP <87>, ISO 10993-4/-10, ADCF, BPOG (E&L), PFAS-free
Raw resin	USP <88> Class VI; ISO 10993-4/-5/-10; ISO 10993-17/-18; FDA 21 CFR 177.1637; EU 10/2011; EC 1935/2004; USP <661.1>; Japanese Food Sanitation Act; RoHS; and the REACH.

FILAMENT SPECIFICATION	
Diameter (mm)	1.75 ± 0.03 mm / 2.85 ± 0.06 mm
Color	Nearly transparent / White
Net filament weight (g)	200 g (+ 0-3%) / 1,000 g (+ 0-3%)
Manufacturing environment	Manufactured and packaged in ISO Class 8 cleanroom
Country of manufacture	Taiwan
Packaging	Aluminum-foil vacuum pack with desiccant

MATERIAL PROPERTIES	
Material	Virgin Polyethylene Naphthalate (PEN)
Density (ISO 1183)	1.325 g/cm^3
Hardness (ASTM D785)	M105
Sterilization compatibility	Gamma sterilization, alcohol-based disinfectants, hypochlorite-based disinfectants, vaporized hydrogen peroxide (VHP), ethylene oxide (EtO) sterilization, and autoclave sterilization (under select conditions).
UV absorbance	UV light below 383 nm is absorbed, protecting the contents. The material retains its mechanical properties under UV sterilization.

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RESPONSIBLY MADE IN TAIWAN

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PEN

PHYSICAL PROPERTIES

	Test Method *1	PEN		
	ISO 527-2	XY	YZ	ZX
Tensile strength (MPa)	50 mm/min	75.2	51.9	22.2
Elongation (%)	50 mm/min	10.1	2.4	0.82
Tensile modulus (MPa)	1 mm/min	2717	2435	2534
	ISO 178:2019			
Flexural strength (MPa)	2 mm/min	100.3	-	67.5
Flexural modulus (MPa)	2 mm/min	2263	-	1976
	ISO 180:2019			
Izod impact strength (kJ/m²)	notched	3.1	-	1.9

3rd party testing by: SGS

THERMAL PROPERTIES

	ISO 75:2020	
HDT (Amorphous, As-printed)	0.45 MPa	116˚C
HDT (Semi-crystalline, Annealed)	0.45 MPa	166˚C

3rd party testing by: SGS

PRINTING PROPERTIES

Nozzle sizes (mm)	0.2 - 0.6	Recommend stainless steel or hardened steel
Nozzle temperature (°C)	280 - 300	Recommended settings may different according to printer and object
Bed temperature (°C)	80 - 100	
Chamber temperature (°C)	40 - 55	
Speed (mm/s)	50 - 70 100 - 140	For 1st layer and walls For infill or draft prototypes
Part cooling fan (%)	0 - 10	May use higher cooling speed for bridges
Retraction speed (mm/s)	30 - 45	
Retraction length (mm)	2 - 7	2 - 4 mm for DD; 4 - 7 mm for Bowden
Bed adhesive	glue stick or PVP	
Drying	70 - 80 ˚C for 4 - 6 hours	Prior to use and if excessive stringing or surface defects
Support material	HIPS or PVA	
Storage	vacuum with desiccant dry-box (< 20% RH)	Long term storage During use and printing

CHEMICAL RESISTANCE TABLE *2

Organic Solvent	PEN	PVDF
Acetic acid (20%)	A	A
Acetone	B	D
Alcohols	A	A
Chloroform	C	A
Dimethyl sulfoxide	C	C
Ethers	A	A
Ethyl acetate	A	D
Gasoline	A	A
Hexane	A	A
Methyl ethyl ketone	A	C
Toluene	A	A

Inorganic Solvent	PEN	PVDF
Ammonium chloride (25%)	A	A
Ammonia aq. (28%)	C	A
Hydrochloric acid (37%)	A	A
Hydrogen peroxide (30%)	A	A
KOH (30%)	B	A
NaCl sat. solution	A	A
$NaHCO_3$ sat. solution	A	A
NaOCl	A	A
NaOH (30%)	A	A
Nitric acid (20%)	A	A
Sulfuric acid (10%)	A	A

NOTES

*1 The values reported in TDS represent the average from a batch of 10 test specimens. For tensile, flexural, and impact properties of the 3D printed test specimens were produced using a 0.4 mm nozzle, 100% infill, print speed of 60mm/s, a nozzle temperature of 282°C and a build plate temperature of 90°C. FLXR Engineering is continuously working on expanding the TDS data

*2 The chemical resistance of PEN is evaluated by the following test method:
Specimens are immersed in the chemical (liquid) at 23°C for 30 days.
Ranking definition: A: weight change <1%, tensile strength retained > 95%; B: weight change between 1~10%, tensile strength retained > 75%;
C: weight change >10%, tensile strength retained < 75%; D: swelled or dissolved within 120 hours.

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