

### GENERAL INFORMATION

PolyEthylene Naphthalate (PEN) is a semi-crystalline thermoplastic polymer that maintains excellent mechanical properties and chemical resistance at high temperatures. As a 3D-printing filament, PEN offers a good balance of performance and cost, making it suitable for applications requiring chemical resistance, high strength, and high-temperature stability.

PEN is among the most chemically resistant polymers for FDM 3D printing. Its high glass transition temperature ( $T_g$ ) ensures mechanical strength retention at elevated temperatures, ideal for parts in chemical, bio-tech, petrochemical, and food industries. PEN complies with FDA food contact safety regulations and has USP 87 certification, enabling its use in food processing and medical applications. Its low creep and friction coefficient (comparable to POM) suit it for food contact environments and medical devices. Printable at up to 140 mm/s on CoreXY printers with minimal warping, PEN offers superior cost-performance compared to PPSU, PVDF, PPS, and PEEK. These attributes position PEN as a cost-effective, high-performance option for applications demanding chemical resistance and productivity.

### IMPORTANT KEY FEATURES

- Superior chemical resistance (see chemical resistance table)
- Temperature resistance: 121°C (amorphous), 153 °C (crystallized)
- Excellent mechanical strength, durability, and low friction.
- Humidity absorption has minimal impact on part strength
- FDA food contact, USP 87 and RoHS2 compliant



### FILAMENT SPECIFICATIONS

- Diameter : 1.75 ± 0.05mm
- Color : translucent
- Net filament weight : 1,000g
- Packaging : packed in vacuum sealed bag with desiccant

### STORAGE AND SHELF LIFE

- Store filament in a sealed package at room temperature (16-28°C).
- Shelf life: 12 months (unopened package)
- Keep away from moisture and direct heat sources.

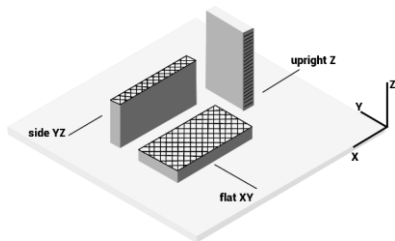
### PRINTING CONDITIONS

- |   |   |
|---|---|
| • Nozzle Temperature (°C) : 270-280°C                             | • Speed (mm/s):   |
| • Bed temperature (°C) : 70-90°C                                  | 50-70 mm/s for mechanical properties and walls  |
| • Retraction speed (mm/s) : 30-45                                 | 100-140 mm/s for infill or draft prototypes   |
| • Retraction length (mm) : 2-4mm                                  | • Drying: No drying is needed prior to printing. After opening the sealed package, use a dry-box / controlled environment during printing (RH <20%). Store in a sealed bag. Dry at 85°C for 12 hours if exposed to excess humidity. |
| • Cooling (%) : 0-10%   |   |
| • Support Material : PVA, HIPS                                    |   |
| • Adhesion : PEI (glue stick or PVP)<br>Glass (glue stick or PVP) |   |

### THERMAL PROPERTIES

- Heat deflection (HDT) at 0.45 MPa ISO 75-2/B (3D Printed Specimen FLAT XY) : 111.7±0.9 °C
- Vicat softening temperature ISO 306/A120 (3D Printed Specimen FLAT XY) : 122.1 ± 0.7 °C
- Specific gravity ISO 1183 : 1.319 g/cc

### PRINTING ORIENTATION



The FDM process creates parts with a layered structure, causing mechanical properties to be anisotropic based on print orientation.\*1

- Flat XY orientation: predominant mechanical strength from infill
- Side YZ orientation: predominant mechanical strength from walls
- Upright Z orientation: interlayer adhesion strength.

	Test Method #	PEN		
		XY	YZ	ZX
	ISO 527-2			
Tensile strength (MPa)	50 mm/min	75.2	51.9	22.2
Elongation (%)	50 mm/min	10.1	2.4	0.5
Tensile modulus (MPa)	1 mm/min	2717	2435	2534
	ISO 178:2019			
Flexural Strength (MPa)	2 mm/min	100.3	-	43.1
Flexural Modulus (MPa)	2 mm/min	2263	-	1976
	ISO180:2019			
Izod Impact Strength kJ/m <sup>2</sup>	notched	3.1	-	1.9

#: 3<sup>rd</sup> party testing by:

### CHEMICAL RESISTANCE TABLE \*2

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

Inorganic Solvent	PEN	PPSU
Ammonium Chloride (25%)	A	A
Ammonia (28%)	C	A
Hydrochloric acid (37%)	A	A
Hydrogen Peroxide (30%)	A	B
KOH (30%)	B	A
NaCl sat. solution	A	A
NaHCO <sub>3</sub> 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 270°C and a build plate temperature of 75°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.

### DISCLAIMER

This information sheet has been prepared with the highest level of care. Unless otherwise stated, it is intended solely for general informational purposes. It should not be relied upon for any specific purpose, and no representations or warranties are made regarding its accuracy or completeness.

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