Fishy Filaments

Recycling marine plastics into 3D printer filament.

Technical Data Sheet
(updated 15th January 2020)
Product Name - Porthcurno
Material - Nylon 6, Polyamide 6, PA 6

Description

Porthcurno is a semi-crystalline nylon blend with high tensile strength, good impact resistance and low surface friction.

Its post-print properties after atmospheric curing or overnight soaking in water make an especially interesting material for use in applications where moderate flexibility and high strength are useful e.g. wearables and live hinges.

Nylon is a technical, engineering grade material and is not recommended for novice users.

As with most nylons, Porthcurno is highly susceptible to absorbtion of moisture both before and after printing.

Filament should be thoroughly dried prior to use and kept in a controlled environment between uses. Insufficient drying prior to use will result in warping, poor surface quality and an increased probability of print failure.

A starting point for 'industrial' drying times is 5+ hours at 80ºC at a controlled humidity of 10% H_2O. Typical 'home' drying solutions will require longer and 12+ hours is recommended for those without industry-style solutions.

Effective drying cannot be achieved reliably at temperatures below 70ºC. Thicker filaments take longer than thinner filaments to dry. The use of domestic ovens to dry filament is not recommended. Ambient humidity will impact drying time.

A heated printer bed is highly recommended as is the use of a suitable bed preparation material e.g. Magigoo PA or 3DLAC.Glass, Garolite and ceramic beds have been proven successful, with Garolite offering the potential for printing of some low-warp risk models on an unheated bed.

Typical Printing Parameters

Nozzle Diameter	> 0.4mm
Bed Temperature	60 - 80 °C
Printing Temperature	250 - 270 °C
Printing Speed	30 - 60 mm/s

Test	Test Standard	SI Unit	Measured Value	Standard Deviation
Tensile Strength (23C)				
Tensile Strength @ Break	ISO 527-2	Mpa	48	6
Elongation @ Break	ISO 527-2	%	3.6	1.2
Tensile Strength @ Yield	ISO 527-2	Mpa	59	2
Elongation @ Yield	ISO 527-2	%	41	18
Tensile Modus	ISO 527-2	Mpa	2262	208
Flex (3 Point)				
Flexural Stress	ISO 178	Mpa	70	2
Flexural Modulus	ISO 178	Mpa	2126	184
Charpy Impact (23C)	ISO180	kj/m²	5.15	0.72
Melting Temperature	ISO 11357-3	ºC	220	-
VICAT	ISO306/B120	ºC	195	0.2

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Printing Tips
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Our Ethos

Porthcurno is an un-compounded Nylon 6, meaning that it has none of the fillers, stabilisers or pigments that many 3D printing filaments contain.

By refusing to add these modifiers it might sound like we're deliberately making things more difficult for our customers, but every additive to the core polymer will make the filament less recyclable and in some cases dilute the underlying strength of the polymer itself. So there is a balance between ease of printing and 'functionality' in the broader sense.

We made a conscious decision for our filament to be 100% recycled in order to give designers the freedom to design for sustainability first.

At the centre of what we're trying to do as a company is help build an industry understanding of the practicalities of Circular Economy-type design principles and products. The focus is to deliver an end print (including all its waste) that has the least environmental impact for equivalent price/performance.

We are finding that industry professionals have a far higher success rate with our material than even very talented hobbyists. Hardware quality is a part of that but a systems-based approach to materials management is a bigger factor. Most of the challenges encountered when using Porthcurno are solvable with minimal investment in hardware and are focussed on moisture control.

Our products are tested internally on a relatively small cross-section of hardware, mainly at the prosumer end of the market, but if you follow some fundamentals the print success rate when using Porthcurno should compare well with other nylon filament brands.

3 TOP TIPS

1. ***ALWAYS DRY YOUR FILAMENT AT 80C OVERNIGHT BEFORE FIRST USE AND REPEAT IF PERFORMANCE DEGRADES OVER TIME***
2. ***KEEP YOUR FILAMENT IN AIRTIGHT STORAGE WHILE PRINTING AND BETWEEN PRINTS***
3. ***CLEAN YOUR BED, HOTEND AND NOZZLE REGULARLY***

Variable	Demonstrated Success Envelope	Limiting factor	Starting Point	Try Varying
Print Speed	10-150 mm/s	Nozzle diameter	40 mm/s	Nozzle temp
Print Temperature	235 - 300 C	Model thickness	265 C	Print Speed
Bed Temperature	Ambient -100 C	Adhesive strength	80C	Z-axis Calibration, bed material
Adhesive	Magigoo (PA), 3DLAC, nylon compatible adhesives	Removal from bed	Magigoo PA	Freshness of adhesive pre-print
Bed Material	Borosilicate Glass Garolite, Ceramic	Adhesive Strength	Borosilicate Glass	Clean bed, add fresh adhesive
Drying	2 weeks after pre-print drying when stored in a dessicating caddy	Atmospheric exposure, ambient humidity	Dry filament overnight at 80C BEFORE first print	Storage environment, Printer enclosure, filament tube
Cleaning	Dependent on hardware component	Some hot-ends can promote internal coating and narrowing of melt chamber	Good quality hot-ends (E3D, Ultimaker Print Cores,3Dgence)	Cleaning frequency. Hot end construction. Retraction settings
Slicer	Simplify3D, Cura, Slic3R	None	Cura 3.6+ with Porthcurno profile installed	Download Cura profile from Ultimaker Marketplace

Designing Out Warping

Warping is common in hygroscopic materials such as nylon and is usually a sign of poor material preparation or insufficient bed adhesion. As such, in most cases it is readily addressed by the means identified above.

However model geometry can also have an impact, with sharp external corners providing a focus for internal stresses and increasing the propensity to peel off the bed.

Consider wider brims, re-orientation of the model and modification of the model. Rounder external corners and shorter straight edges tend to spread the internal stress over a larger area reducing the load that the adhesive must undergo. Custom brim geometries (e.g. the Mickey Mouse ear) can also help spread the load around areas with high propensity to peel.