ENVIRONMENTAL PRODUCT DECLARATION

Thrive® matter Nylon 6 Fiber

Solution-Dyed Nylon 6 Carpet Fiber

Thrive® matter is a premium nylon 6 fiber with outstanding performance, durability, and exceptional color, delivered with an extremely low carbon footprint.

Universal Fibers

Universal Fibers® is a global leader and innovator in solution-dyed, sustainable fiber and brilliant color application. Experts in the craft of technology, sustainability, color, finishes, and performance, for over 50 years and ever-true today, our purpose has been to help people, commerce, and the planet thrive together.

As we look forward, we aim to elevate and inspire the industry with thoughtful fiber solutions and diverse product offerings delivered with a dramatically lower carbon footprint.

UL CERTIFIED ENVIRONMENTAL PRODUCT DECLARATION UL.COM/EPD

ENVIRONMENTAL PRODUCT DECLARATION

Universal Fibers

Thrive® matter Nylon 6 Fiber
Nylon 6 Fiber

According to ISO 14025, EN 15804, and ISO 21930:2017

EPD PROGRAM AND PROGRAM OPERATOR NAME, ADDRESS, LOGO, AND WEBSITE	UL Environment 333 Pfingsten Road, Northbrook, IL 60611 https://www.ul.com/ https://spot.ul.com
GENERAL PROGRAM INSTRUCTIONS AND VERSION NUMBER	General Program Instructions v2.5 March 2020
MANUFACTURER NAME AND ADDRESS	Universal Fibers 14401 Industrial Park Road Bristol, VA 24202
DECLARATION NUMBER	4790371040.101.2
DECLARED UNIT	1 kg of fiber
REFERENCE PCR AND VERSION NUMBER	Part B: Requirements on the EPD for Synthetic carpet yarns. IBU v1.6 2017
DESCRIPTION OF PRODUCT APPLICATION/USE	Variety of applications including carpet fiber, automotive products, etc.
MARKETS OF APPLICABILITY	Global
DATE OF ISSUE	April 1, 2022 (updated December 1, 2023)
PERIOD OF VALIDITY	5 Years
EPD TYPE	Product-specific
RANGE OF DATASET VARIABILITY	N/A
EPD SCOPE	Cradle-to-Gate
YEAR(S) OF REPORTED PRIMARY DATA	2022
LCA SOFTWARE & VERSION NUMBER	Sphera LCA FE 10.7.1.28 (formerly GaBi)
LCI DATABASE(S) & VERSION NUMBER	Sphera MLC 2023.2 (formerly GaBi Database)
LCIA METHODOLOGY & VERSION NUMBER	TRACI 2.1, CML 4.2

The PCR review was conducted by:	Institut Bauen und Umwelt PCR Review Panel info@ibu-epd.com
This declaration was independently verified in accordance with ISO 14025: 2006. ☐ INTERNAL ☒ EXTERNAL	Cooper McC Cooper McCollum, UL Environment
This life cycle assessment was conducted in accordance with ISO 14044 and the reference PCR by:	Logan Pensinger, Universal Fibers & WAP Sustainability
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:	James Mellentine, Thrive ESG

LIMITATIONS

Exclusions: EPDs do not indicate that any environmental or social performance benchmarks are met, and there may be impacts that they do not encompass. LCAs do not typically address the site-specific environmental impacts of raw material extraction, nor are they meant to assess human health toxicity. EPDs can complement but cannot replace tools and certifications that are designed to address these impacts and/or set performance thresholds – e.g. Type 1 certifications, health assessments and declarations, environmental impact assessments, etc.

Accuracy of Results: EPDs regularly rely on estimations of impacts; the level of accuracy in estimation of effect differs for any particular product line and reported impact.

Comparability: EPDs from different programs may not be comparable. Full conformance with a PCR allows EPD comparability only when all stages of a life cycle have been considered. However, variations and deviations are possible". Example of variations: Different LCA software and background LCI datasets may lead to differences results for upstream or downstream of the life cycle stages declared.

1. Product Definition and Information

1.1. Description of Company/Organization

Universal Fibers® is a global leader and innovator in solution-dyed, sustainable fiber and brilliant color application. We work in close collaboration and partnership with valued customers and friends, who inspire us to continue to anticipate and solve for the needs of an ever-changing and diverse industry.

Our mission is to create products that inspire and enrich our industry, while innovating processes and technologies that protect the health of our environment.

1.2. Product Description

Product Identification

This EPD covers Thrive® matter Nylon 6 Fiber. Thrive® matter is a premium nylon 6 fiber, available in each of our exclusive finishes for 'ready to tuft' packages. Available in our full palette of colors, with no limitation to possibilities for creating bespoke combinations from each of our unique building blocks. Access to Universal Fibers' High-Bulk | Low-Weight technology can help achieve the lowest carpet weights on the market, answering the demand for low weight, high-performance carpet with low carbon footprints. Global production assures availability from each of our plant locations.

Product Average

Thrive® matter Nylon 6, also known as polyamide 6 (PA6), is manufactured in three different Universal Fibers® facilities located around the world: Bristol, Virginia, United States; Taicang, China; and Gorzów, Poland.

The fiber is available in multiple deniers and colors. This study utilizes a weighted average approach from 2022 to obtain the impacts of 1 kg of fiber.

1.3. Application

Thrive® matter Nylon 6 fiber can be used in a variety of applications, including, but not limited to, carpet fiber and automotive products.

1.4. Technical Data

Since the technical data can vary based on specific applications of the fiber, ranges are included in the table below.

Parameter	Unit	Value*	Testing Method
Denier	g/9000m	600-3600	ASTM D1907
Antistatic Protection (max.)	kV	3.5	AATCC 134
Acid-Dye Stain Resistance	AATCC Red 40 Stain Scale	8-10	AATCC 175
Interior Carpet UV Resistance (after 200 afu exposure) (min.)	% retention	50	AATCC 16-E
Light Fastness	Gray Scale for Color Change	3-5	AATCC 16
Water Fastness Change In Color	Gray Scale for Color Change	4-5	AATCC 107-1991
Rubbing Fastness	Gray Scale for Color Change	4-5	AATCC 8-1989

*These results apply to those samples tested and are not necessarily indicative of all apparently identical or similar products.

1.5. Declaration of Methodological Framework

This EPD is a cradle-to-gate study.

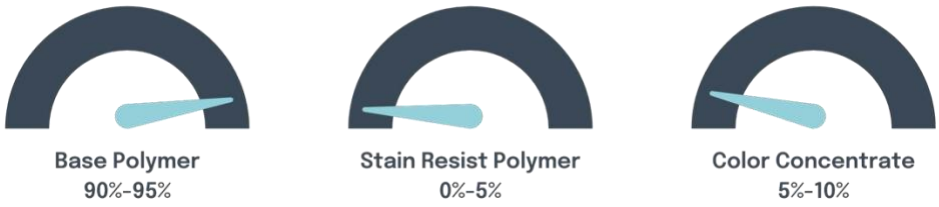
1.6. Properties of Declared Product as Delivered

Thrive® matter Nylon 6 fibers are packaged onto cones which are stacked on pallets and then shrink-wrapped to be delivered to the customer.

1.7. Material Composition

Raw materials for the product were obtained from various locations globally, including the United States, Europe, and China. The general composition of the product is represented in the table below.

Material Composition per Declared Unit



The recycled content within Universal Fibers® Thrive® matter nylon 6 products is independently third-party certified through GreenCircle® Certified.

1.8. Manufacturing

Because Thrive® matter Nylon 6 fiber is produced in three different facilities located in the United States, Poland, and China, each facility was modeled independently and combined using a weighted average of annual production.

After the polymer materials arrive at the regional Universal Fibers® facility, they are stored and conveyed into the building where they are extruded with color concentrates and spun into fiber. This fiber is added to cardboard tubes which are used to hold the fiber until it heads downstream to be turned into yarn. The cardboard tubes are reused as often as possible for new fiber to minimize waste. Manufacturing inputs and outputs per declared unit were calculated by using measured or estimated data per processing step.

Each Universal Fibers® manufacturing facility maintains both ISO 14001 and ISO 9001 certification.

1.9. Environment and health during manufacturing

All national guidelines are followed and recommended personal protective equipement (PPE) are utilized by all associates.

1.10. Packaging

After being turned into yarn, the fiber is stacked and stored in cardboard boxes until it is sent to the customer. This study includes the disposal of packaging that is delivered to the customer. Packaging materials are also included in the model and the values were calculated via direct measurement.

1.11. Extraordinary Effects

Fire Protection: The fiber's fire performance is measured once used within a final product.

Water: The fiber is not expected to have any extraordinary effects when exposed to water for extended periords of time.

Mechanical destruction: The fiber is not expected to have any extraordinary effects when mechanically destructed.

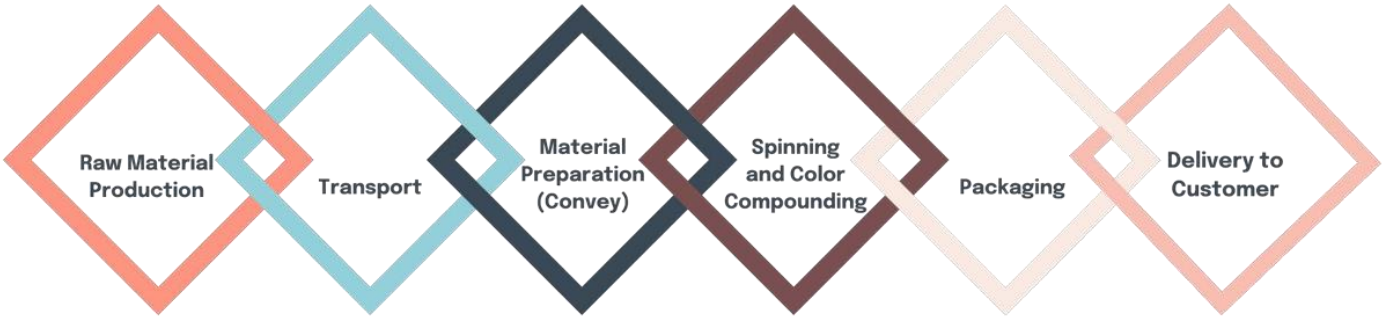
2. Life Cycle Assessment Background Information

2.1. Declared Unit

The declared unit of this study is 1 kg of fiber as delivered to the customer.

2.2. System Boundary

This LCA is a Cradle-to-Gate study. An overview of the system boundary is shown below.



System Boundary Summary

2.3. Estimates and Assumptions

All estimates and assumptions are within the requirements of ISO 14040/44.

- The inclusion of overhead water data was determined appropriate due to the inability to sub-meter and isolate manufacturing water from total water.
- The use and selection of secondary datasets from GaBi – The selection of which generic dataset to use to represent an aspect of a supply chain is a significant value choice. Collaboration between the LCA practitioner, the manufacturer, and GaBi data experts was valuable in determining best-case scenarios in the selection of

data. However, no generic data can be a perfect fit. Improved supply chain specific data would improve the accuracy of results, however budgetary and time constraints have to be taken into account.

2.4. Cut-off Criteria

All inputs in which data was available were included. Material inputs greater than 1% (based on total mass of the final product) were included within the scope of analysis. Material inputs less than 1% were included if sufficient data was available to warrant inclusion and/or the material input was thought to have significant environmental impact. Cumulative excluded material inputs and environmental impacts are less than 5% based on total weight of the functional unit.

The list of excluded materials and energy inputs include:

- Propane forklifts at the facility were excluded due to their energy use being well below the cutoff criteria
- Due to the minimal amount of natural gas that is used for die burn-off at the spinneret heads, this was excluded from the analysis.
- Some material inputs may have been excluded within the GaBi datasets used for this project. All GaBi datasets have been critically reviewed and conform to the exclusion requirement of the PCR, Part A: “Calculation Rules for the Life Cycle Assessment and Requirements on the Background Report”.

2.5. Data Sources

Primary data were collected by facility personnel and from direct measurement by manufacturing process. Whenever available, supplier data was used for raw materials used in the production process. When primary data did not exist, secondary data for raw material production was utilized from Sphera’s LCA FE 10.7.1.28, MLC 2023.2.

2.6. Data Quality

Geographical Coverage

The geographical scope of the manufacturing portion of the life cycle is the United States, China, and Poland. All primary data were collected from the manufacturer. The geographic coverage of primary data is considered excellent.

The geographical scope of the raw material acquisition is global, focusing on the United States, China, and several countries in Europe.

In selecting secondary data (i.e. background Datasets), priority was given to the accuracy and representativeness of the data. When available and deemed of significant quality, country-specific data was used. However, priority was given to technological relevance and accuracy in selecting secondary data. This often led to the substitution of regional and/or global data for country-specific data. Overall geographic data quality is considered good.

Time Coverage

Primary data were provided by the manufacturer and represent all information for calendar year 2022. Using this data meets the PCR requirements. Time coverage of this primary data is considered excellent.

Data necessary to model cradle-to-gate unit processes was sourced from Sphera LCI datasets. Time coverage of the GaBi datasets varies from approximately 2010 to present. All datasets rely on at least one 1-year average data. Overall time coverage of the datasets is considered good and meets the requirement of the PCR that all data be updated within a 10-year period.

Technological Coverage

Primary data provided by the manufacturer is specific to the technology the company uses in manufacturing their product. It is site-specific and considered of good quality. It is worth noting that the water used in manufacturing the product includes overhead water such as sanitary use of water. Sub-metering was not available to extract process-only water use from the total water use. Sub-metering would improve the technological coverage of data quality.

Data necessary to model cradle-to-gate unit processes was sourced from Sphera MLC datasets. Technological coverage of the datasets is considered good relative to the actual supply chain of the manufacturer. While improved life cycle data from suppliers would improve technological coverage, the use of lower-quality generic datasets does meet the goal of this LCA.

Completeness

The data included is considered complete. The LCA model included all known material and energy flows, with the exception of what is listed in Section 2.4. As pointed out in that section, no known flows above 1% were excluded and the sum of all excluded flows totals less than 5%.

2.7. Period under Review

The period under review is calendar year 2022.

2.8. Allocation

General principles of allocation were based on ISO 14040/44. To derive a per-unit value for manufacturing inputs such as water and wastewater, allocation based on total production by mass was adopted. As a default, secondary GaBi datasets use a physical mass basis for allocation.

3. Life Cycle Assessment Scenarios

Material Composition per Declared Unit

	VALUE	UNIT
Biogenic Carbon Content in product	0	kg C
Biogenic Carbon Content in accompanying packaging	0.16	kg C

4. Life Cycle Assessment Results

Description of the system boundary modules

	PRODUCT STAGE			CONSTRUCT-ION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARY
	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
	Raw material supply	Transport	Manufacturing	Transport from gate to site	Assembly/Install	Use	Maintenance	Repair	Replacement	Refurbishment	Building Operational Energy Use During Product Use	Building Operational Water Use During Product Use	Deconstruction	Transport	Waste processing	Disposal	Reuse, Recovery, Recycling Potential
EPD Type: Cradle to Gate	X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

4.1. Life Cycle Impact Assessment Results

North American Impact Assessment Results

TRACI v2.1	A1	A2	A3	A4-A5	B1-B7	C1-C4
AP [kg SO_2 eq]	1.27E-03	7.93E-04	1.14E-03	MND	MND	MND
EP [kg N eq]	1.32E-04	5.99E-05	1.94E-04	MND	MND	MND
GWP [kg CO_2 eq]	6.47E-01	1.23E-01	4.23E-01	MND	MND	MND
ODP [kg CFC 11 eq]	6.83E-12	3.25E-16	2.13E-14	MND	MND	MND
Resources [MJ]	1.49E+00	2.28E-01	9.81E-01	MND	MND	MND
POCP [kg O_3 eq]	2.30E-02	2.02E-02	1.82E-02	MND	MND	MND

EU Impact Assessment Results

CML v4.2	A1	A2	A3	A4-A5	B1-B7	C1-C4
GWP 100 [kg CO_2 eq]	6.47E-01	1.23E-01	4.23E-01	MND	MND	MND
ODP [kg CFC-11 eq]	6.23E-12	1.81E-14	5.88E-13	MND	MND	MND
AP [kg SO_2 eq]	1.08E-03	5.94E-04	9.56E-04	MND	MND	MND
EP [kg PO_4^{-3} eq]	1.60E-04	1.42E-04	2.51E-04	MND	MND	MND
POCP [kg ethene eq]	1.25E-04	-1.29E-04	1.02E-04	MND	MND	MND
$ADP_{element}$ [kg Sb-eq]	3.61E-07	7.19E-09	3.77E-08	MND	MND	MND
ADP_{fossil} [MJ, LHV]	8.54E+00	1.44E+00	6.53E+00	MND	MND	MND

4.2. Life Cycle Inventory Results

Resource Use

PARAMETER	A1	A2	A3	A4-A5	B1-B7	C1-C4
RPR_E [MJ, LHV]	3.28E-01	6.14E-02	2.58E+00	MND	MND	MND
RPR_M [MJ, LHV]	0.00E+00	0.00E+00	0.00E+00	MND	MND	MND
RPR_T [MJ, LHV]	3.28E-01	6.14E-02	2.58E+00	MND	MND	MND
$NRPR_E$ [MJ, LHV]	9.91E+00	1.71E+00	-4.03E+00	MND	MND	MND
$NRPR_M$ [MJ, LHV]	1.54E+00	0.00E+00	1.41E+01	MND	MND	MND
$NRPR_T$ [MJ, LHV]	1.15E+01	1.71E+00	1.01E+01	MND	MND	MND
SM [kg]	9.07E-01	0.00E+00	0.00E+00	MND	MND	MND
RSF [MJ, LHV]	4.94E-23	0.00E+00	0.00E+00	MND	MND	MND
NRSF [MJ, LHV]	5.80E-22	0.00E+00	0.00E+00	MND	MND	MND
RE [MJ, LHV]	0.00E+00	0.00E+00	0.00E+00	MND	MND	MND
FW [m^3]	1.44E-03	2.06E-04	3.43E-03	MND	MND	MND

Output Flows and Waste Categories

PARAMETER	A1	A2	A3	A4-A5	B1-B7	C1-C4
HWD [kg]	4.05E-09	4.78E-12	2.26E-09	MND	MND	MND
NHWD [kg]	4.71E-02	1.53E-04	8.96E-02	MND	MND	MND
HLRW [kg] or [m^3]	1.12E-07	5.31E-09	8.22E-07	MND	MND	MND
ILLRW [kg] or [m^3]	9.55E-05	4.48E-06	6.86E-04	MND	MND	MND
CRU [kg]	0.00E+00	0.00E+00	0.00E+00	MND	MND	MND
R [kg]	0.00E+00	0.00E+00	4.15E-02	MND	MND	MND
MER [kg]	0.00E+00	0.00E+00	0.00E+00	MND	MND	MND
EE [MJ, LHV]	0.00E+00	0.00E+00	0.00E+00	MND	MND	MND

Carbon Emissions and Removals

PARAMETER	A1	A2	A3	A4-A5	B1-B7	C1-C4
BCRP [kg CO2]	0.00E+00	0.00E+00	0.00E+00	MND	MND	MND
BCEP [kg CO2]	0.00E+00	0.00E+00	0.00E+00	MND	MND	MND
BCRK [kg CO2]	0.00E+00	0.00E+00	1.63E-01	MND	MND	MND
BCEK [kg CO2]	0.00E+00	0.00E+00	1.08E-01	MND	MND	MND
BCEW [kg CO2]	0.00E+00	0.00E+00	0.00E+00	MND	MND	MND
CCE [kg CO2]	0.00E+00	0.00E+00	0.00E+00	MND	MND	MND
CCR [kg CO2]	0.00E+00	0.00E+00	0.00E+00	MND	MND	MND
CWNR [kg CO2]	0.00E+00	0.00E+00	0.00E+00	MND	MND	MND

5. LCA Interpretation

The vast majority of the impacts of the fiber come from the production of the raw materials utilized, followed by the energy used during manufacturing. Increasing the use of supplier-specific data would increase the accuracy of the study.

6. Additional Environmental Information

6.1. Environmental Activities and Certifications

Universal Fibers® has elected to partner with Carbonfund.org to have its Thrive® matter products Carbon*free*® Certified. Per their website: "The Carbon*free*® Product Certification program uses life cycle assessments (LCAs) to determine the greenhouse gas (GHG) emissions over a product's entire life cycle. GHG emissions that cannot be reduced or eliminated from the product's life cycle are offset or 'neutralized' with third-party validated renewable energy, energy efficiency, and forestry carbon offset projects."

7. References

1. Product Category Rules for Building-Related Products and Services Part A: Life Cycle Assessment Calculation Rules and Report Requirements UL – 10010 Version 3.2. UL Environment. 2019.
2. Part B: Requirements on the EPD for Synthetic carpet yarns. Version 1.6 IBU. 2017.
3. ISO 14044: 2006 Environmental Management – Life cycle assessment – Requirements and Guidelines.
4. ISO 14044: 2006/ Amd 1:2017 Environmental Management – Life cycle assessment – Requirements and Guidelines – Amendment 1.
5. ISO 14025:2006 Environmental labels and declarations – Type III environmental declarations – Principles and Procedures.
6. CML-IA Characterization Factors. 5 September 2016. https://www.universiteitleiden.nl/en/research/research-output/science/cml-ia-characterisation-factors
7. TRACI: The Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts. Version 2.1 – User Guide - https://nepis.epa.gov/Adobe/PDF/P100HN53.pdf.
8. Life Cycle Assessment, Universal Fibers, LCA for EPD Generation Tool Report for Universal Fibers Thrive Fiber. WAP Sustainability Consulting. January 2022.
9. EN 15804 + A1:2013, Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products.
10. ISO 21930:2017, Sustainability in buildings and civil engineering works -- Core rules for environmental product declarations of con- struction products and services.
11. GaBi LCA Database Documentation. https://gabi.sphera.com/america/support/gabi/