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Fibers

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UNPARALLELED CHEMISTRY

# Nylon 6,6



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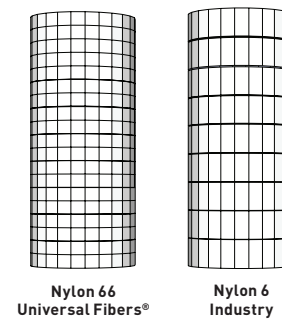
# Nylon Carpet Fiber Type 6,6 by Universal Fibers®

## Fiber History

Until the 1920s, the majority of fibers used in carpet manufacturing were natural cotton and wool. In the years that followed, scientists created a class of synthetic polymers called "polyamides," later referred to as "nylon." This exciting advancement in chemistry led to nylon carpet fiber, which combined natural styling aesthetics with improved wear performance and stain resistance. The first nylon developed was "type 66" followed by "type 6". Today these two nylon fiber types are utilized by the majority of carpet manufactures throughout the world.

## Molecular Advantage

Nylon 6 and 6,6 are essentially composed of carbon, hydrogen, oxygen and nitrogen. However, due to the hydrogen bonding process within each type, there is a molecular difference. Type 6 is derived from caprolactum, which allows two ways for hydrogen atoms to bond, one of which is not directly aligned. This results in a longer, more open molecular structure. Type 6,6 nylon is derived from adipic acid and hexamethylene diamine, each of which contains six hydrogen atoms. When the two ingredients combine, hydrogen atoms are in direct alignment, thus creating a tight symmetrical unit of 6+6 within a strong, dense molecular structure.



## Nylon 6,6 + Universal Fibers = Great Chemistry

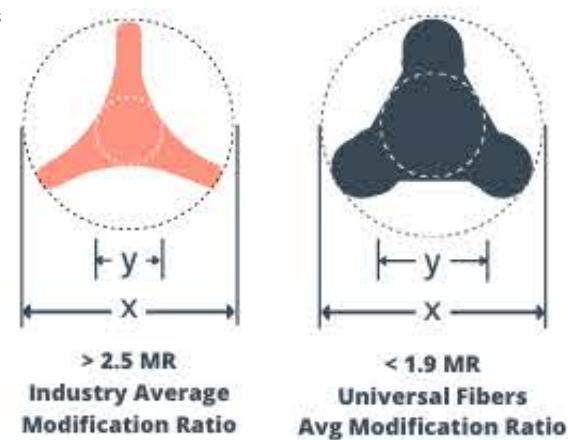
Universal Fibers® believes in the premium performance advantages of nylon 6,6. With its high melt point and low flammability, type 6,6 fiber is resistant to frictional heating that can impact new carpet appearance and wear. Due to its tight dense molecular structure, nylon 6,6 is less permeable and thus inherently stain resistant. As fiber experts, Universal Fibers further enhances the advantage of nylon 6,6 with leading performance features and design attributes, including solution-dyed Universal Color®, permanent stain resistance, modified delta filament (MDF), an average modification ratio of less than 1.9 (MR), and leading sustainability with GreenCircle® certification.

More than an incredible palette of 284 colors, Universal Color is a "color system" scientifically designed to deliver virtually any color in the spectrum. Improved care and maintenance is achieved with an MR average of less than 1.9, reducing the length of longer lobes that can collapse with wear and trap soil and stains. Our permanent stain-resist technology is built in and inherent in the fiber. It is not a topically applied fluorochemical and cannot be washed off in maintenance or worn off in traffic. Best of all, permanent stain resistance is recyclable and contains no red-list ingredients. Universal Fibers offers the most sustainable solution-dyed nylon 6,6 carpet fibers in the world with Prisma consisting of 20% pre-consumer recycled content and a low CO<sub>2</sub> generation in production.

## Prisma®

### Nylon 6,6 by Universal Fibers – Differentiated Features and Benefits

- Average MR < 1.9
- 100% solution-dyed color
- Low CO<sub>2</sub> emission vs. virgin nylon 6,6
- High bulk, lightweight coverage
- Outstanding flammability resistance
- Independent GreenCircle® Certification
- Universal Color® - Palette of 284 with 9 metallic lusters
- Permanent stain resistance - Built in, not topically applied
- 20% Pre-consumer recycled content, N6,6



## Fiber Performance Comparison in Carpet Type 66 vs. Type 6

Test Method	Type 66 Universal Fibers Built-In PSR 1.791 MR (1)	Type 6 Industry Applied TSR 2.44 MR (2)	Type 6 Industry W/O TSR 2.44 MR (3)
<b>Colorfastness (5=Best)</b>			
AATCC 16-04 - Light - 200 AFU	5	5	5
AATCC 129-05 Ozone - 2 Cycles	5	5	5
AATCC 164-06 Oxides of Nitrogen	5	5	5
AATCC 165-06 Oxides of Nitrogen	5	5	5
Bleach - 25%	5	5	5
Bleach - 100%	5	5	5
<b>Wear &amp; Performance</b>			
ASTM D6962 German Roll Chair - 10,000	3.5	2.5	3.0
ASTM D6962 German Roll Chair - 25,000	3.0	2.0	2.5
Phillips Roll Chair - 10,000 cycles	3.5	2.5	3.0
Phillips Roll Chair - 25,000 cycles	3.0	2.0	2.5
Tuft Bind Average (10=Best)	7.9	5.7	8.3
<b>Soiling</b>			
ASTM D6540-05 Accelerated Soil			
After Vacuum (ave.)	1.16	1.0	1.0
After Extraction (ave.)	4.83	3.16	3.16
<b>Stain Resistance to Red Dye 40 (10=Best)</b>			
AATCC 175-08 Red Dye 40 Stain Resist	9.5	5.0	3.0
<b>Resistance to Staining</b>			
Coffee	4.5	4.5	4.5
Motor Oil	3.0	2.0	2.0
Mustard	4.5	4.0	4.0
Betadine	2.5	1.0	1.0
Cherry Kool-Aid	2.5	2.0	1.0
<b>Flammability (.90=Superior)</b>			
ASTM E648 Critical Radiant Flux	.90 Watts/Sq Cm, Avg.	.50 Watts/Sq Cm, Avg.	.63 Watts/Sq Cm, Avg.

1. Test number 1377640: 2410 PA66 2 STEP- Solution-dyed Nylon 66 with built-in permanent stain resistance (PSR) and MR 1.791 Non-Pattern, Enhanced Loop, Face Weight: 20.4oz, Pile Height: .21875", Gauge: 10, Stitches per Inch: 9, Color: Solid, Neutral/Beige\*
  2. Test number 1361932: 1200/2 PA6 1 STEP- Solution-dyed Nylon 6 with applied topical stain resistance (TSR) and MR 2.44 Non-Pattern Level Loop, Face Weight: 26oz, Pile Height: .21875", Gauge: 10, Stitches per Inch: 9, Color: Solid, Neutral/Beige\*
  3. Test number 1361932X: 1200/2 PA6 1 STEP- Solution-dyed Nylon 6 without applied topical stain resistance (TSR) and MR 2.44 Non-Pattern Level Loop, Face Weight: 26oz, Pile Height: .21875", Gauge: 10, Stitches per Inch: 9, Color: Solid, Neutral/Beige
- All fiber tested, produced by Universal Fibers in accordance with Universal Fibers specification standards and/or industry norms.
  - Test results may vary due to carpet, construction and color.
  - Independent testing conducted by Professional Testing Laboratory Inc Dalton, Georgia, USA
  - AATCC: American Association of Textile Chemists and Colorists
  - ASTM: American Society for Testing and Materials
  - All samples tested; Universal Color® 1-71 Rye
  - Test results numerically defined from 0-5 with 5=Best unless otherwise noted

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