

LENZING™ for Protective Wear 



the origin of solutions

smart solutions from botanic origins

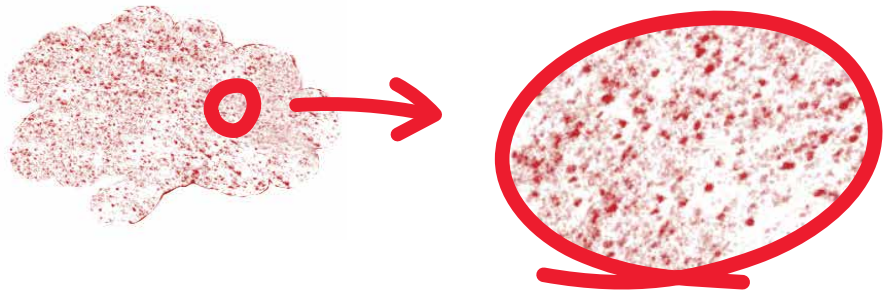


LENZING™ for Protective Wear

LENZING™ FR is a sustainably produced inherently flame-resistant cellulosic fiber based on Lenzing's renowned Modal fiber production process. LENZING™ FR fibers meet the definition of "inherently flame retardant and resistant fibers" as specified by the European Man-made Fibers Association (CIRFS).

LENZING™ FR is commonly blended with other high performance fibers to produce unique protective solutions for a variety of industrial applications. LENZING™ FR fibers typically contribute both protective qualities and enhanced comfort to these fabric blends. By enhancing the breathability of the fabric, they offer a significant reduction of heat stress, a major concern especially in hot climates.

LENZING™ FR
Fiber cross section
(example illustration)



Permanently incorporated protection
with LENZING™ FR

technologies



FR technology and flame resistance

LENZING™ FR is commonly blended with other high performance fibers to produce unique protective fabric blend solutions for a wide range of industrial applications. Blending partners include aramids (including both meta- and para-aramid), wool, nylon, modacrylic, polybenzimidazole (PBI) and others.

Such blends are designed with the right blending partners, fabric weight and fabric structure to provide the desired properties. Correctly engineered, these fabric blends offer protection and a significant reduction of heat stress in hot climatic regions, largely owing to the unique features of the LENZING™ FR fiber, which enable it to contribute both protective qualities and enhanced comfort to typical blends. Blends are designed to provide the optimum balance between functionality and comfort in applicable working conditions for different user groups and different end user exposure levels.

Blends containing LENZING™ FR can be engineered to comply with all relevant global standards for protective wear, including ISO EN 11612 (Europe) for heat and flame, NFPA 2112 (USA) for flash fires, NFPA 1971 for structural fire fighting, NFPA 1977 for wildland fire fighting, NFPA 1975 for station uniforms for fire fighters, EN 469 protective clothing requirements for fire fighting, EN 15614 Laboratory test requirements and NFPA 70E (USA) which includes electric arc protection. Some newer fabrics are tested against multiple standards.



ISO EN 11612:2015 Protective clothing - Clothing to protect against heat and flame - Minimum performance requirements
NFPA 2112 Standard on Flame-Resistant Clothing for Protection of Industrial Personnel Against Short-Duration Thermal Exposures from Fire (US)
NFPA 1971 Standard on Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting
NFPA 1977 Standard on Protective Clothing and Equipment for Wildland Fire Fighting
NFPA 1975 Standard on Emergency Services Work Clothing Elements
EN 469 Protective clothing for firefighters. Performance requirements for protective clothing for firefighting
EN 15614 Protective clothing for firefighters - Laboratory test methods and performance requirements for wildland clothing
NFPA 70E Standard for Electrical Safety in the Workplace (US)

LENZING™ FR color

Color fastness test according to EN ISO 105

	Black	Navy Blue	Olive Green	Royal Blue	Signal Red	Desert Sand	Yellow
Fastness to washing, 60°C / 95°C	5/4-5	5/4-5	5/5	5/4-5	5/4-5	5/5	5/4-5
Fastness to washing Hypochlorite	5	4	4-5	4-5	4-5	4	4
Bleach fastness Hypochlorite	5	4	4-5	4-5	4-5	4	4
Bleach fastness Peroxide	4	4	4-5	4-5	4	4-5	4
Fastness to water	5	5	5	5	5	5	5
Fastness to sublimation	5	4	5	4	4-5	5	4
Perspiration resistance Ac/Al	4-5/5	5/5	5/5	5/5	5/4-5	5/5	5/5
Rubbing resistance dry/wet	5/3	4-5/2-3	5/4-5	5/4-5	5/4	5/4-5	5/4
Light fastness (Xenon)	7	7	7	7	7	7	7

Color Stability

Wash tests show with LENZING™ FR color the wash water remains clear and no color washout was observed. Thus LENZING™ FR fibers retain long-lasting color vibrancy.



Eco Color technology

This eco-responsible technology offers long-lasting color-fastness – particularly to light and bleaching – contributing to design flexibility in textiles. Fibers produced under the Eco Color technology have been certified with the EU Ecolabel for textile products (AT/016/001), a label of environmental excellence awarded to products meeting high environmental standards throughout their life cycle.

Sustainable production: Dope-dyed LENZING™ FR fibers provide efficient ecological advantages, substituting for the resource-intensive conventional dyeing process. This brings significant life cycle savings of water and energy from cradle to finished fabric, for example up to 50% of energy and water savings as well as a 60% reduced carbon footprint, resulting in lower environmental impact compared to conventionally dyed fabrics. Dope-dyed LENZING™ FR fibers retain long-lasting color vibrancy, including the popular color Black, better than conventionally dyed fiber, and are less prone to fade even after repeated washing. Wash tests show that with LENZING™ FR and Eco Color the wash water remains clear and no washout was observed.

key benefits



botanic origin

LENZING™ FR fibers are inherently flame-resistant cellulose fibers produced using the Modal fiber production process. LENZING™ FR fibers are mainly manufactured from beech wood, sourced from sustainably grown forests in Austria and neighboring countries. Beech wood forests are a natural and renewable source of raw material. A big share of the wood used at the Lenzing site comes from Austria, harvested from certified or controlled sources following the stringent guidelines of the Lenzing Wood and Pulp Policy.

LENZING™ FR fibers have earned United States Department of Agriculture (USDA) BioPreferred® designation.

key benefits



Forest



Wood



Pulp



Fiber



Yarn



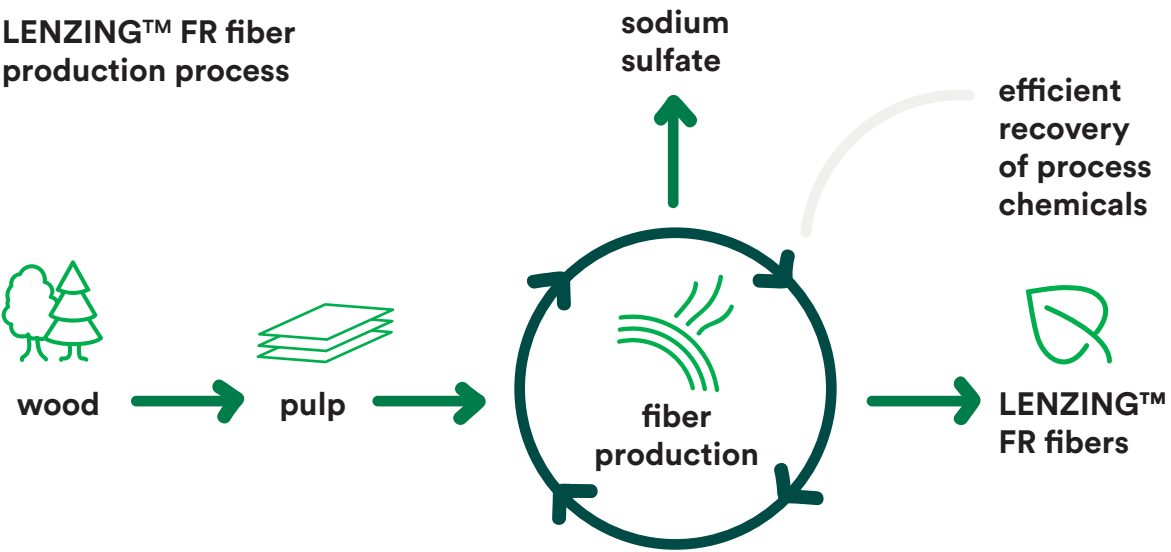
Fabric



End product



LENZING™ FR fiber production process



key benefits



sustainable production

Fully integrated pulp and fiber production at the Lenzing site in Austria makes it possible to produce LENZING™ FR fibers in an eco-responsible way. At Lenzing, we strive to safeguard resources for future generations by the use of renewable energy from the pulp mill and by the recovery of remaining components as co-products. Numerous Lenzing innovations have been integrated in the production of LENZING™ FR fibers, to make the process environmentally sound.

Dope-dyed LENZING™ FR fibers provide efficient ecological advantages substituting for the resource-intensive conventional dyeing process. This brings significant life cycle savings of water and energy from cradle to finished fabric; for example up to 50% of energy and water savings as well as a 60% reduced carbon footprint, resulting in a much lower environmental impact compared to conventionally dyed fabrics.

key benefits

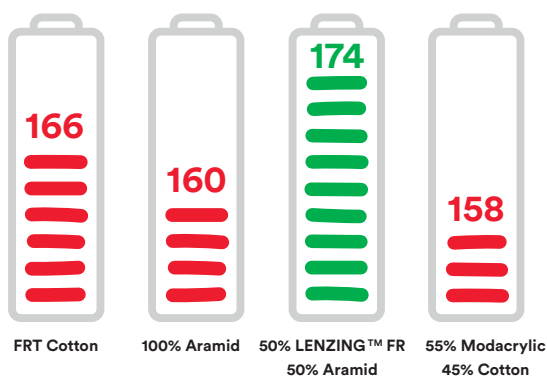


moisture management

Fabrics made from LENZING™ FR fibers support body temperature regulating properties through their moisture management. Derived from natural material, the cellulose structure of the fibers regulates the absorption and release of moisture, contributing to fabric breathability that supports the body's natural thermal regulation. A comparative study of a variety of fabrics commonly worn by firefighters found that a blend of LENZING™ FR and aramid fibers showed the smallest rise in both core body temperature and skin temperature, leading to enhanced physical performance. LENZING™ FR cellulose fibers have a higher vapor uptake than both cotton and synthetic fibers.

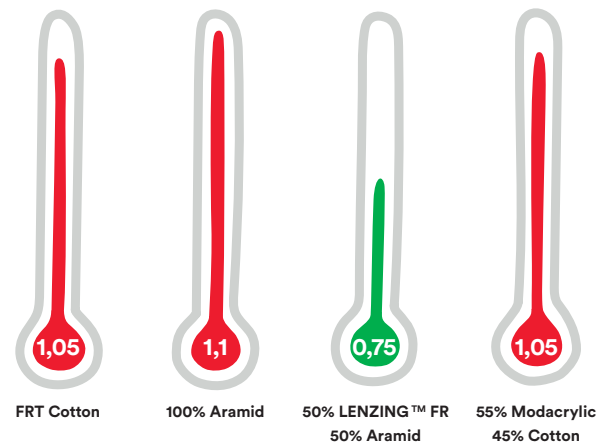
key benefits

average load in an anaerobic zone



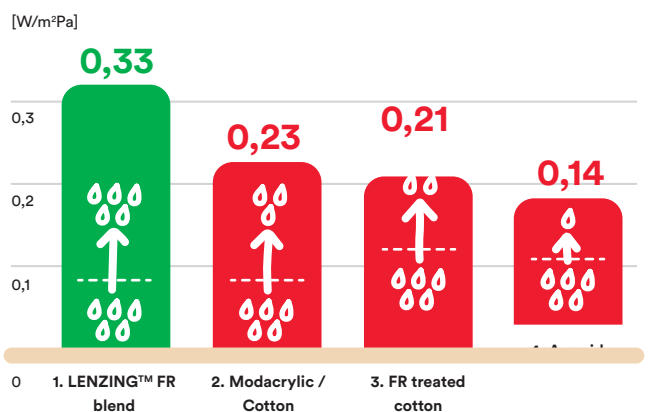
Illustrates the comparative workload (performance) efficiency as the body approaches the anaerobic mode of muscle usage. LENZING™ FR blends enhance muscular efficiency by providing more efficient cooling, using less oxygen for cooling and releasing more for exercise.

average core body temperature - difference



Illustrates the greater effectiveness of LENZING™ FR blends in reducing body heat build-up. Figures shown are before and after a workout according to a work load protocol.

higher breathability with LENZING™ FR



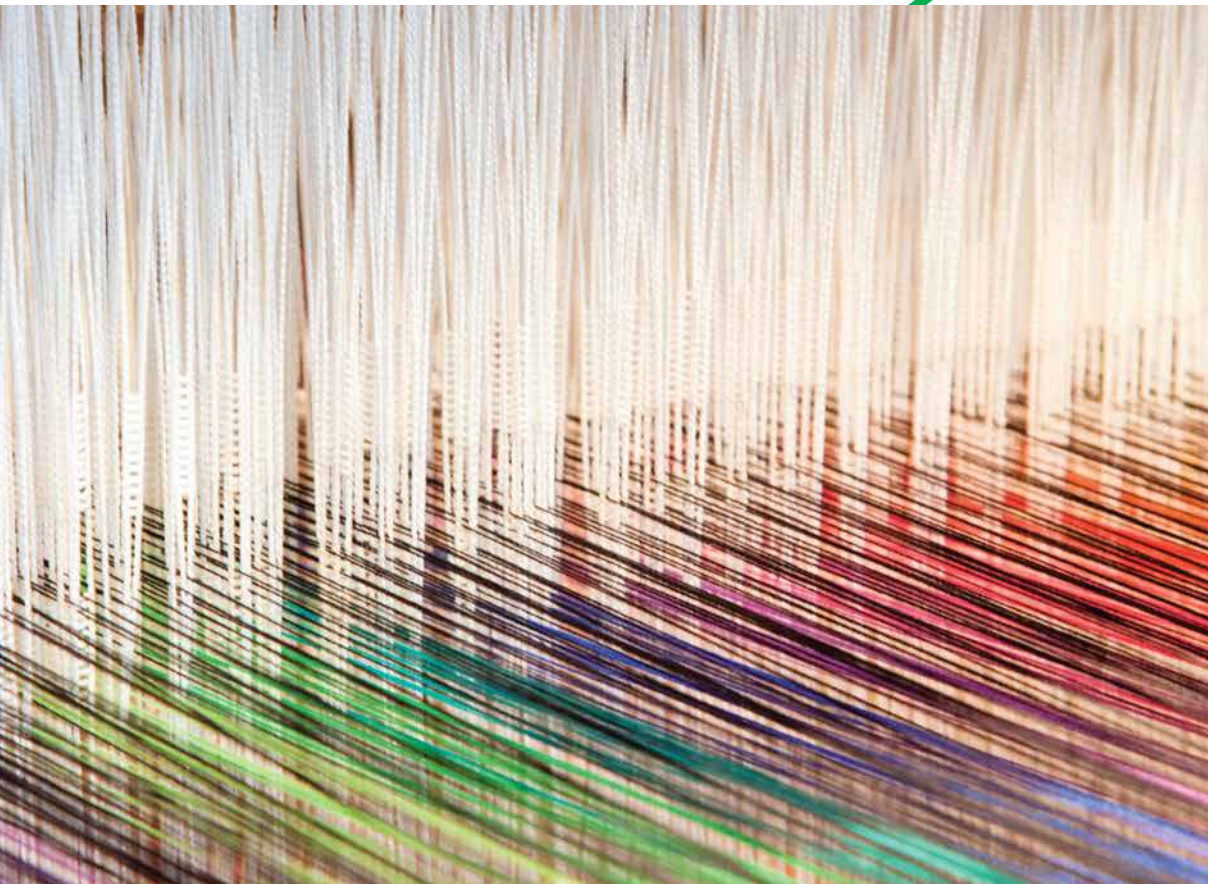
Illustrates the enhanced breathability provided by LENZING™ FR blends.

- * Lenzing In-House-Testing: sweating-guarded/hotplate test according to ISO 11092:2014
- 1. LENZING™ FR Aramid 50/50: Fabrics 250 g/m²
- 2. Modacrylic/Cotton 55/45: Fabrics 250 g/m²
- 3. FR treated cotton: Fabrics 280 g/m²
- 4. Aramid: Fabrics 260 g/m²



color retention (LENZING™ FR fibers & Eco Color technology)

Color pigments embedded in dope-dyed fiber retain long-lasting color vibrancy better than conventionally dyed fiber, in particular fastness to light and to bleaching, and are less prone to fade even after repeated washing. Wash tests show that with LENZING™ FR and Eco Color the wash water remains clear and no visible washout was observed.



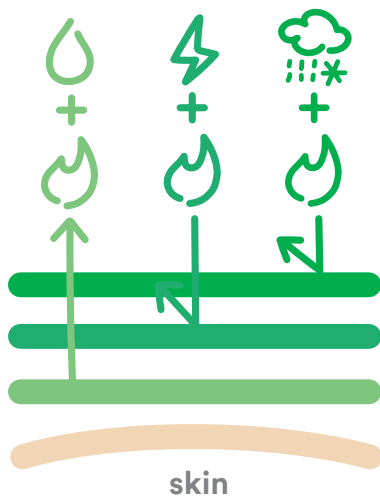
key benefits

the complete solution

the complete solution



layer system provides customized protection for all environments



- 1 Flame-resistant weather protection gear
- 2 Flame-resistant protective clothing
- 3 Flame-resistant & moisture management functional wear

fire fighting usage



fire fighting usage



fire fighting usage

LENZING™ FR blends offer unique solutions in all three areas of this application: wildland, structural firefighting, and station wear.

In structural fire fighting very low RET data of LENZING™ FR fibers (a measure of fabric breathability), scientifically recorded, shows a big improvement in reducing fatigue and heat stress, the number one killer of fire fighters in the USA.

High performance LENZING™ FR fiber blends offer a solution-based complete concept for fire fighters, combining efficient flame and heat protection with improved physiological performance and enhanced comfort. The “layers” concept includes protective wear with direct skin contact like underwear, hoods and gloves, as well as outer layers such as jackets and trousers. In turnout gear LENZING™ FR can be used in the facecloth, thermal/moisture barrier and the outer shell. Extensive tests on multi-layer garments under European standard EN469 confirm the effectiveness of LENZING™ FR blends in combining protection with comfort.



military and police usage



military and police usage

LENZING™ FR blends for the military have been proven for many years, offering protection, comfort and durability. These blends are easy to print in camouflage prints with infrared properties that comply with demanding military specifications.

The US military conducted testing on a number of different flame-resistant fabrics over an extended period, and finally chose a blend with 65% LENZING™ FR as offering superior 4-second flash fire protection with outstanding comfort and physiological performance.



military and police usage



“

In our profession, it's reassuring to know that LENZING™ FR blends provide us with proven flame protection for those vital few seconds we need in dangerous situations. But that's not their only benefit – it gets hot and uncomfortable carrying a heavy pack, so their enhanced breathability helps keep us cool and comfortable on the move.

”

oil & gas usage



oil & gas industry usage

Both upstream and downstream Oil & Gas personnel face an imminent risk of flash fires, where regular clothing catches fire and continues to burn after ignition, causing fatal clothing fires. Consequently many Oil & Gas companies follow the US NFPA 2112 Flash Fire standard for Oil & Gas, which requires a comprehensive battery of testing.

Many Oil & Gas personnel work in very hot climatic conditions, in which 100% synthetic fabrics can provide protection but poor comfort. LENZING™ for Protective Wear forms part of a complete solution with the concept of different layers of fabric, from underwear to outer shell. The efficient moisture management and enhanced breathability of LENZING™ FR fibers contribute to blends which can provide an efficient solution to the industry's needs in this regard by enhancing the fabric's moisture management.



metal industry usage



metal industry usage

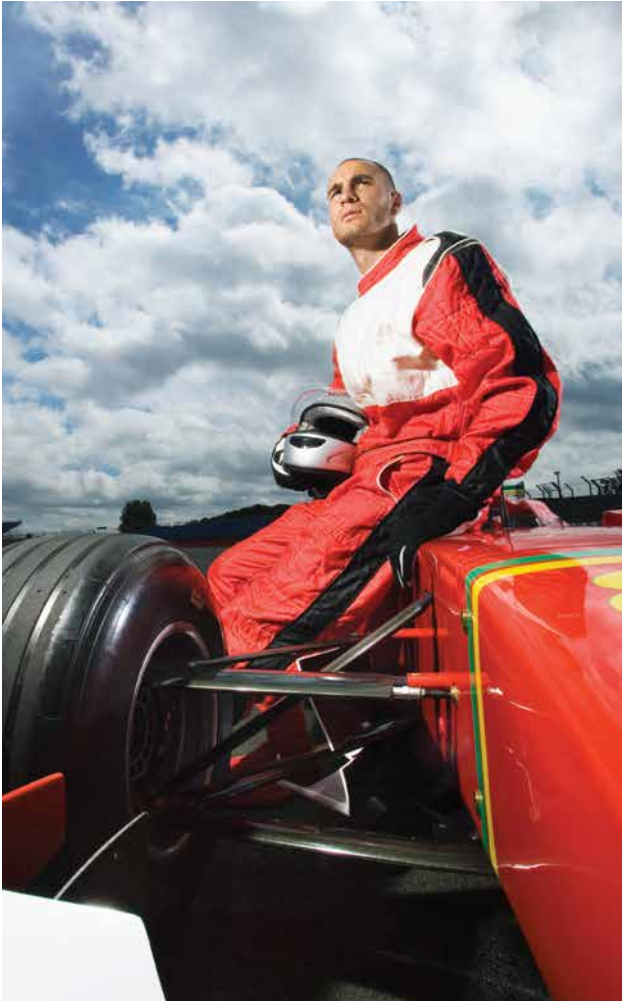


metal splash protection

Personnel in metal smelting operations face inherently difficult conditions, including high ambient and radiant heat and metal splashes that can cause regular clothing to catch fire. Engineered blends incorporating LENZING™ FR fibers provide unique solutions for this industry against both ferrous and non-ferrous metals, in particular in the primary aluminum Industry, where it has previously been very difficult to provide workers with comfortable protection against the very aggressive mineral cryolite. Many global aluminum corporations are using LENZING™ FR blends, some for the past 20 years.

motor sports usage

motor sports usage



motor sports usage

Racing drivers face a risk of a fuel-based fire when an engine overheats or as a result of a collision. Consequently the sport's governing bodies require drivers to wear multilayer protective suits with hood and gloves in compliance with FIA Standard 8856-2000, Protective Clothing for Automobile Drivers. Formerly these garments were extremely hot to wear, creating discomfort and a high risk of heat exhaustion. The introduction of breathable LENZING™ FR blends for the innermost layer combines protection with much improved comfort for race drivers, helping to regulate body temperature and keeping them cool and dry without limiting the garments' protective properties.



electric arc usage

Typical Protective Clothing Systems

Hazard Risk Category	Clothing Description (Number of clothing layers is given in parentheses)	Total Weight oz/yd ²	Minumum Arc Thermal Performance Exposure Value (ATPV)* or Breakopen Threshold Energy (E _{BT})* Rating of PPE cal/cm ²
0	Untreated cotton (1)	4.5-7	N/A
1	FR shirt and FR pants (1)	4.5-8	5
2	Cotton underwear plus FR shirt and FR pants (2)	9-12	8
3	Cotton underwear plus FR shirt and FR pants plus FR coverall (3)	16-20	25
4	Cotton underwear plus FR shirt and FR pants plus FR double layer switching coat and pants (4)	24-30	40

*ATPV is defined in the ASTM P S58 standard arc test method for flame resistant (FR) fabrics as the incident energy that would just cause the onset of a second degree burn (1.2 cal/cm2). EBT is reported according to ASTM P S58 and is defined as the highest incident energy which did not cause FR fabric breakopen and did not exceed the second-degree burn criteria. EBT is reported when ATPV cannot be measured due to FR fabric breakopen.



electric arc protection

The Arc Flash phenomenon is now receiving global attention, and numerous countries have introduced legally binding regulations requiring electrical maintenance personnel to wear appropriate Arc PPE (Personal Protective Equipment). The US NFPA 70E and IEC 61482-2 specifications are widely accepted as the applicable standards in this regard. Engineered blends incorporating LENZING™ FR fibers and Lenzing special technology now offer inherently fire-resistant, lightweight breathable solutions with high Arc Thermal Performance Values (ATPV).

NFPA 70E Standard for Electrical Safety in the Workplace (US)
IEC 61482-2 Protective Clothing against Thermal Arc Hazards of an Electric Arc



electric arc usage

key benefits



social responsibility: human rights and labor relations

Lenzing Group is committed to conducting business in a manner that respects the rights and dignity of all people. Lenzing respects internationally recognized human and labor rights of all employees. Lenzing adheres to its Lenzing Global Code of Business Conduct.



fiber data

Fiber Portfolio

Titer	dtex	1.7	2.2	3.3	5.5	8.9
Cut Length	mm	40/51	38/51/80/90	51/75/90	80	80/120
		dull	dull	dull	dull	dull

Fiber Profile

Strength	cN/tex	25	25	24	24	18
Elongation	%	13	15	15	16	23
Wet Strength	cN/tex	14	14	13	13	6
Elongation	%	13	13	13	14	24
Bisfa Modulus	cN/tex/5%	4	4	3	3	2
Moisture	%	10	10	10	10	10

fiber data and disclaimer

disclaimer

Owing to their intrinsic properties, LENZING™ FR fibers are inherently flame-resistant with an LOI of >28. Please be advised that although the fibers are inherently flame-resistant, the protective properties of the final product depend on the respective fiber blend, the way the fibers have been processed, other materials used in the production process of the yarn or fabric, as well as the combination of the final products with other protective wear and the appropriate use thereof. The specific protection provided by the final product is to be assessed on a case-by-case basis and is indicated by the respective product certification. The use of LENZING™ FR fibers does not replace the need for relevant certification.

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Innovative by nature

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