

# Merino wool: the original performance fibre

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THE  
WOOLMARK  
COMPANY



### **100% NATURAL**

Wool is 100% natural, grown year-round by Australia's 68 million sheep. Sheep consume a simple blend of water, air, sunshine and grass.



### **100% RENEWABLE**

Every year, Australian sheep produce a new fleece, making wool a completely renewable fibre.



### **100% BIODEGRADABLE**

When a wool fibre is disposed of, it will naturally decompose in soil. When wool degrades, it slowly releases valuable nutrients back into the earth.



# Merino wool: a natural fibre

100% NATURAL, RENEWABLE AND BIODEGRADABLE, AUSTRALIAN WOOL IS NATURE'S MIRACLE FIBRE, OFFERING A NATURAL SOLUTION TO THE GLOBAL APPAREL AND FOOTWEAR INDUSTRY.



# ENVIRONMENTAL IMPACT

More than 8 million tonnes of plastics enter the ocean each year.<sup>1</sup> As much as 35 per cent of microplastics in the marine environment are fibres from synthetic clothing, an amount that continues to increase.<sup>2</sup> By contrast, wool fibres readily biodegrade in both land and marine environments.

Wool presents numerous environmentally conscious advantages over other synthetic fibres.

## WOOL FIBRES

vs

## MAN-MADE FIBRES



natural



petroleum based



recyclable



landfill



requires less washing



requires more washing



biodegradable



non-biodegradable



renewable



non-renewable

## TEXTILE WASTE

87% of material used for clothing production is landfilled or incinerated after its final use.<sup>3</sup> If the textile industry continues on this path, more than 150 million tonnes of clothing would be landfilled or burned in 2050.<sup>4</sup>

Wool is the most recycled of fibres, giving it a second and possibly third life, keeping wool from landfill much longer than other fibre types.<sup>5</sup>

## HOW DOES WOOL BIODEGRADE?

Wool is composed of the natural protein keratin, which is similar to the protein that makes up human hair. When keratin is broken down naturally by microorganisms, the products do not pose any environmental hazard.

## WOOL RETURNS ESSENTIAL NUTRIENTS TO THE SOIL

On burial in soil, wool becomes a slow-release fertiliser providing nutrients for uptake and growth by other organisms. This is known as natural closed loop recycling; restoring the initial inputs of soil and grass. Other beneficial effects of adding wool to soils include enhanced water holding capacity, improved water infiltration, soil aeration and reduced erosion.



# Merino wool: a natural fibre

## BIODEGRADABILITY OF WOOL COMPARED TO MAN-MADE FIBRES

When wool is disposed of, it will naturally decompose in soil, slowly releasing valuable nutrients back into the earth.

Synthetic fibres, on the other hand, can be extremely slow to degrade or never decompose and significantly contribute to the world's overflowing landfills.

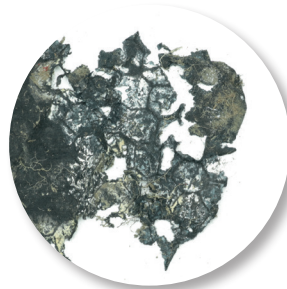
### 100% WOOL



CONTROL



3 MONTHS



6 MONTHS

### 100% POLYESTER



CONTROL

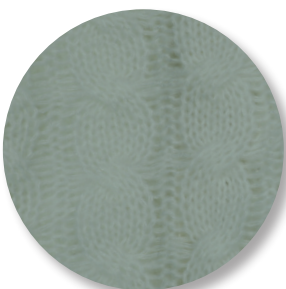


3 MONTHS

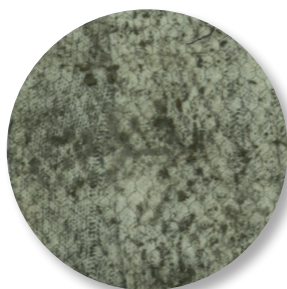


6 MONTHS

### 100% ACRYLIC



CONTROL



3 MONTHS



6 MONTHS



# THE AUSTRALIAN WOOL INDUSTRY IN A SNAPSHOT

Australian woolgrowers work to ensure their sheep are cared for in a way that meets the Five Freedoms and constantly look for improvements in their management practices.

The Five Freedoms are defined as:

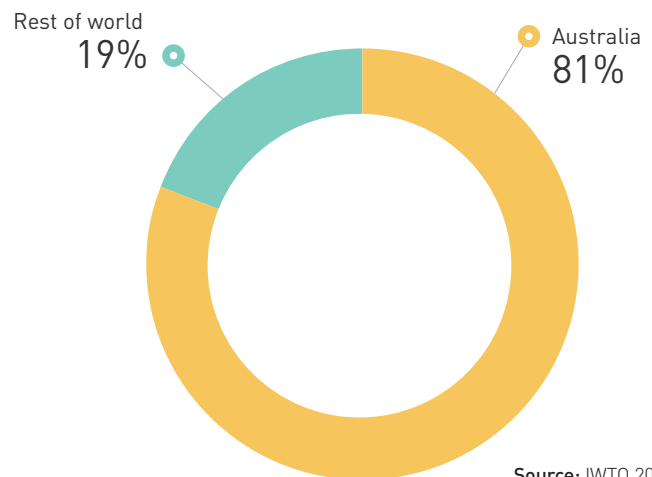
- Freedom from hunger and thirst
- Freedom from discomfort
- Freedom from pain, injury and disease
- Freedom to express normal behaviours
- Freedom from fear and distress

The Woolmark Company and Australian woolgrowers collaborate with universities, industry bodies, government departments and research institutions to ensure their management practices are scientifically-based and proven to ensure the best welfare of their animals.

Not all wool is the same. Merino wool, especially Merino wool of 20.5 micron and finer, is the best wool type for apparel, especially next-to-skin and base-layer garments due to its superior performance characteristics.

Australia is the leading producer of high quality Merino wool.

## GLOBAL PRODUCTION OF SUPERFINE MERINO WOOL 18.5 MICRON OR FINER



Source: IWTO 2019

**SINCE 1936, AUSTRALIAN WOOLGROWERS HAVE INVESTED IN THE FUTURE SUSTAINABILITY OF THEIR INDUSTRY.**

**SINCE 2001, AUSTRALIAN WOOLGROWERS HAVE INVESTED**

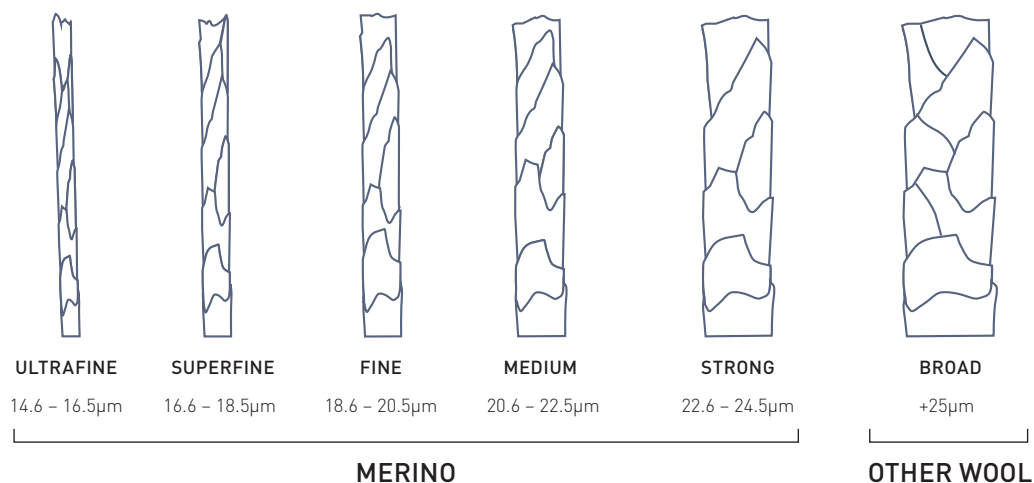
**AU\$74.5 MILLION**

**INTO RESEARCH AND DEVELOPMENT THAT FOCUSES ON THE HEALTH AND WELFARE OF THEIR SHEEP.**



## COMPARING THE QUALITY OF WOOL

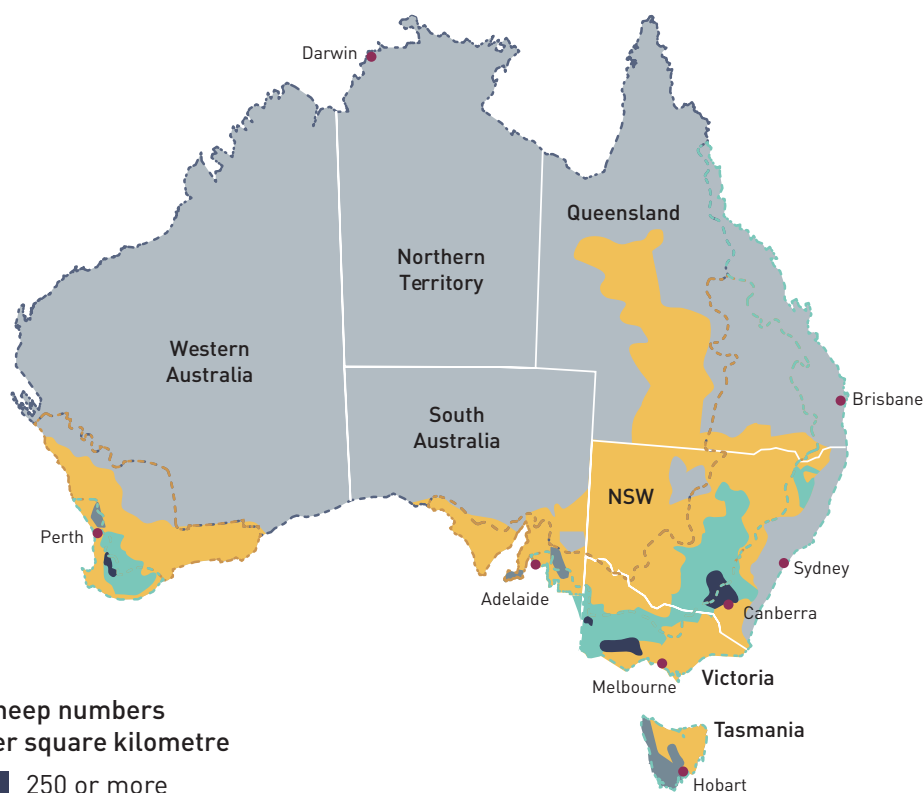
The quality of wool is determined by a number of characteristics including the micron, staple strength and length, colour and type of wool. The micron (mean fibre diameter) is the main characteristic that determines the value and end use of wool fibres.



## WHERE IS WOOL GROWN IN AUSTRALIA?

THERE ARE 68 MILLION SHEEP IN AUSTRALIA AND 70% OF ALL SHEEP IN AUSTRALIA ARE MERINO.

Wool is grown across Australia from wet hill country to dry rangelands with different Merino types bred to suit different climates.



Sheep numbers per square kilometre

- 250 or more
- 100 to 250
- 10 to 100
- less than 10

- High-rainfall zone
- Wheat-sheep zone
- Low-rainfall zone (pastoral zone)

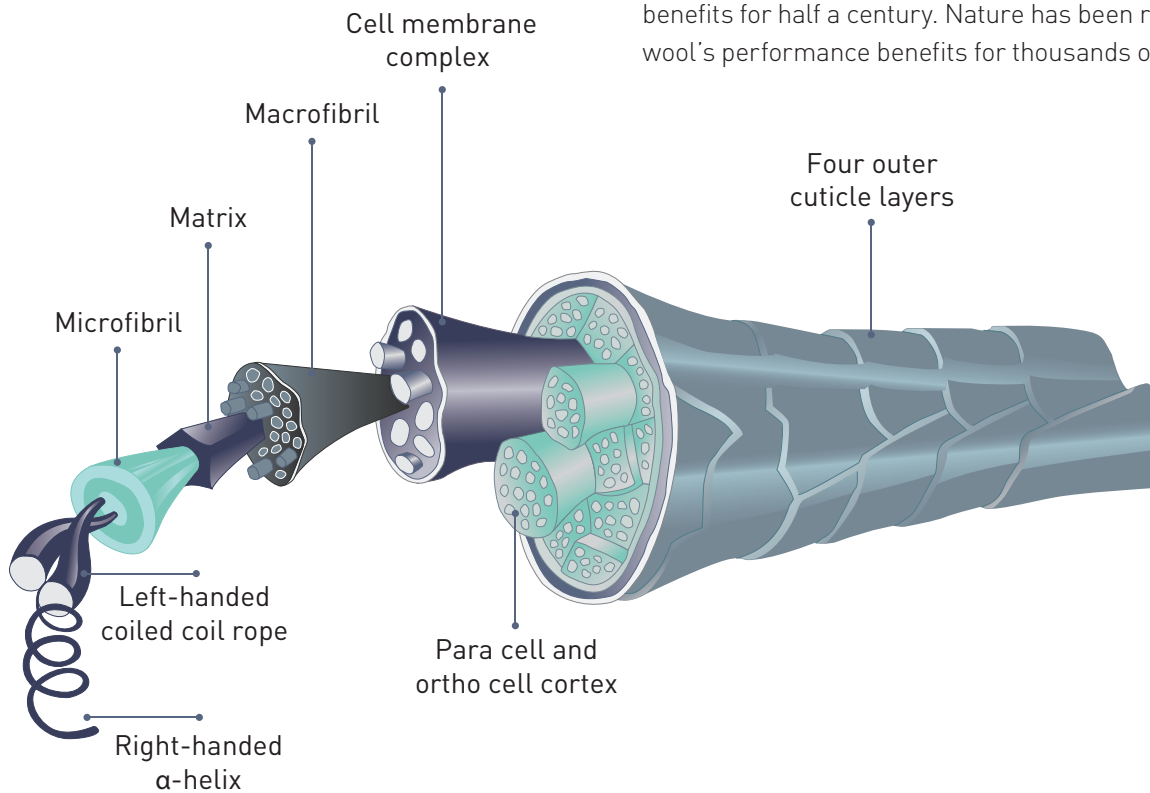


# THE STRUCTURE OF WOOL FIBRE

## THE PERFORMANCE FIBRE

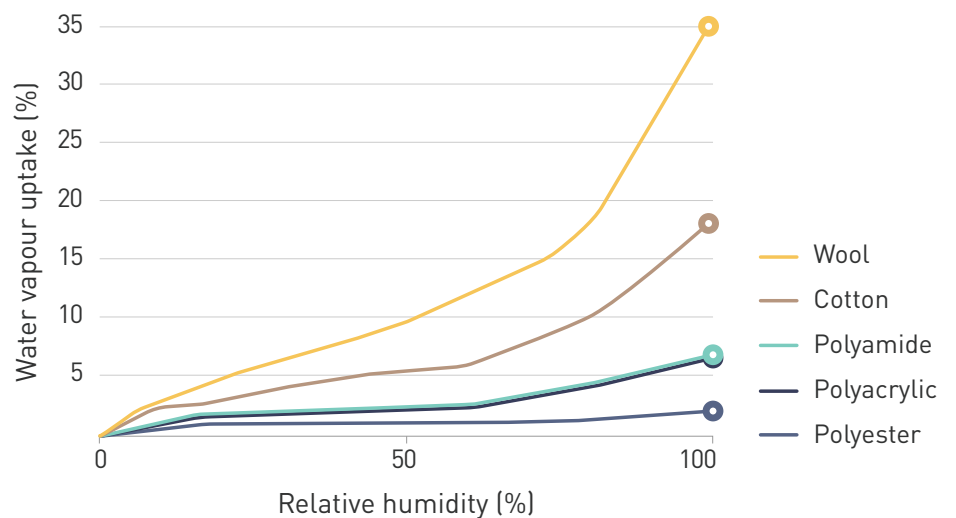
Merino wool is one of the world's most technically advanced fibres, with unique moisture and temperature regulation properties. It is used by athletes across the world, engaging in various low, mid and high-intensity levels of activity.

Man-made fibres have been striving for performance benefits for half a century. Nature has been refining wool's performance benefits for thousands of years.



## UNDERSTANDING MOISTURE TRANSPORTATION

In hot climates or during strenuous exercise, the microclimate above the skin becomes saturated with vapour. This can cause the wearer to become clammy unless their clothing, such as clothes made from Merino wool, can transport this moisture vapour away from the skin



Water vapour uptake of fabrics

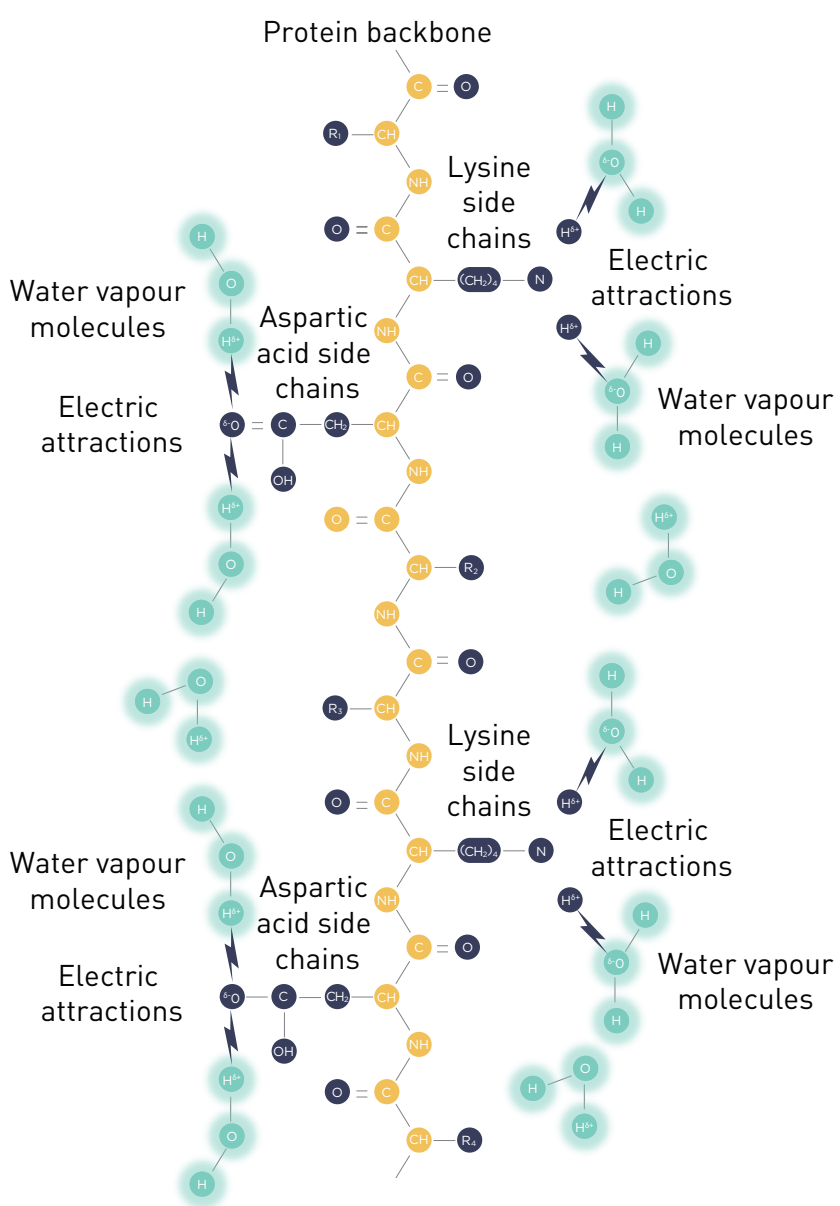


# Merino wool: a performance fibre

## HOW THE UNIQUE STRUCTURE OF WOOL AFFECTS ITS PERFORMANCE

The chemical bonding within a Merino wool fibre has the effect of allowing the fibres to transfer moisture vapour away from the skin.

Without this effective dispersal system, the vapour simply condenses to form sweat droplets on the skin's surface causing discomfort and clamminess. The diagram represents the unique fibre structure of Merino wool's electronically charged side chains that are responsible for generating the moisture vapour transfer away from the skin, which ensures the comfort and moisture management of high-performance Merino wool garments.



A molecular view of a wool fibre



# MERINO WOOL BENEFITS



## MOISTURE MANAGEMENT

Merino wool fibres can transfer large quantities of moisture vapour from the body, which are then evaporated into the air. This means the microclimate next to skin stays dryer and avoids the discomfort associated with sweat. Wool's moisture management also reduces the severity of post-exercise chill. When you stop exercising in very cold conditions, you can experience three times more chilling in synthetic garments than when wearing wool garments.



## BREATHABILITY

The scientific term for "breathability" is moisture buffering. Moisture buffering refers to the fabric's capacity to transfer moisture vapour from the microclimate next to the skin and release it again on the outer side of the garment. Merino wool clothing does this extremely well, making wool garments highly breathable and the wearer less prone to clamminess.



## TEMPERATURE REGULATION

Sweating is nature's temperature regulator – the evaporation of liquid from the skin's surface produces a very efficient cooling effect. Clothing can obstruct this process and cause overheating. However, compared to clothing made from other fibres, Merino wool's process of vapour transfer allows the wearer to remain cooler which results in cooler muscles that are able to work at higher intensity levels.



## ODOUR RESISTANT

Merino wool's complex chemical structure locks odour molecules within the fibre and only releases them on washing. This ensures Merino wool resists unpleasant odours often experienced with other fibres used for activewear.



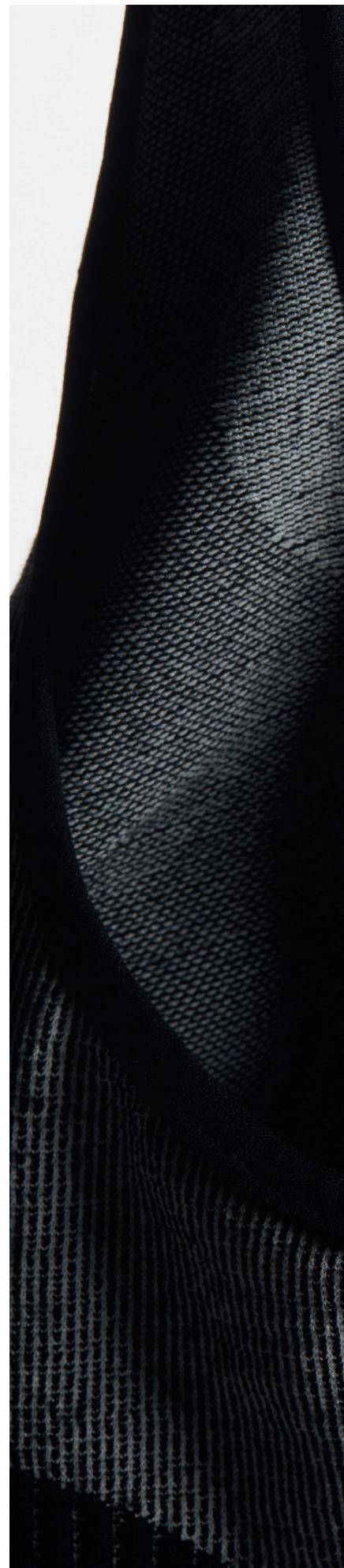
## EASY CARE

Due to Merino wool's odour and stain resistance, garments require less washing. Most Merino wool products can be machine washed and tumble dried.



## STAIN RESISTANT

Merino wool fibres have a natural protective outer layer that helps prevent stains from being absorbed. Furthermore, because Merino wool tends not to generate static, it attracts less dust and lint.



# Merino wool: a performance fibre



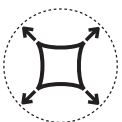
## UV PROTECTION

Merino wool fibres naturally absorb UV radiation, offering protection to wearers of Merino wool garments when exposed to sunshine.



## FIRE RESISTANT

The Merino fibre is naturally fire resistant due to its relatively high moisture and nitrogen content. Whilst cotton catches alight at 255°C, the temperature must reach 570-600°C before wool will ignite; while polyester melts at 252-292°C and nylon succumbs at an even lower 160-260°C, wool never melts so it can't stick to the skin like many common synthetics.



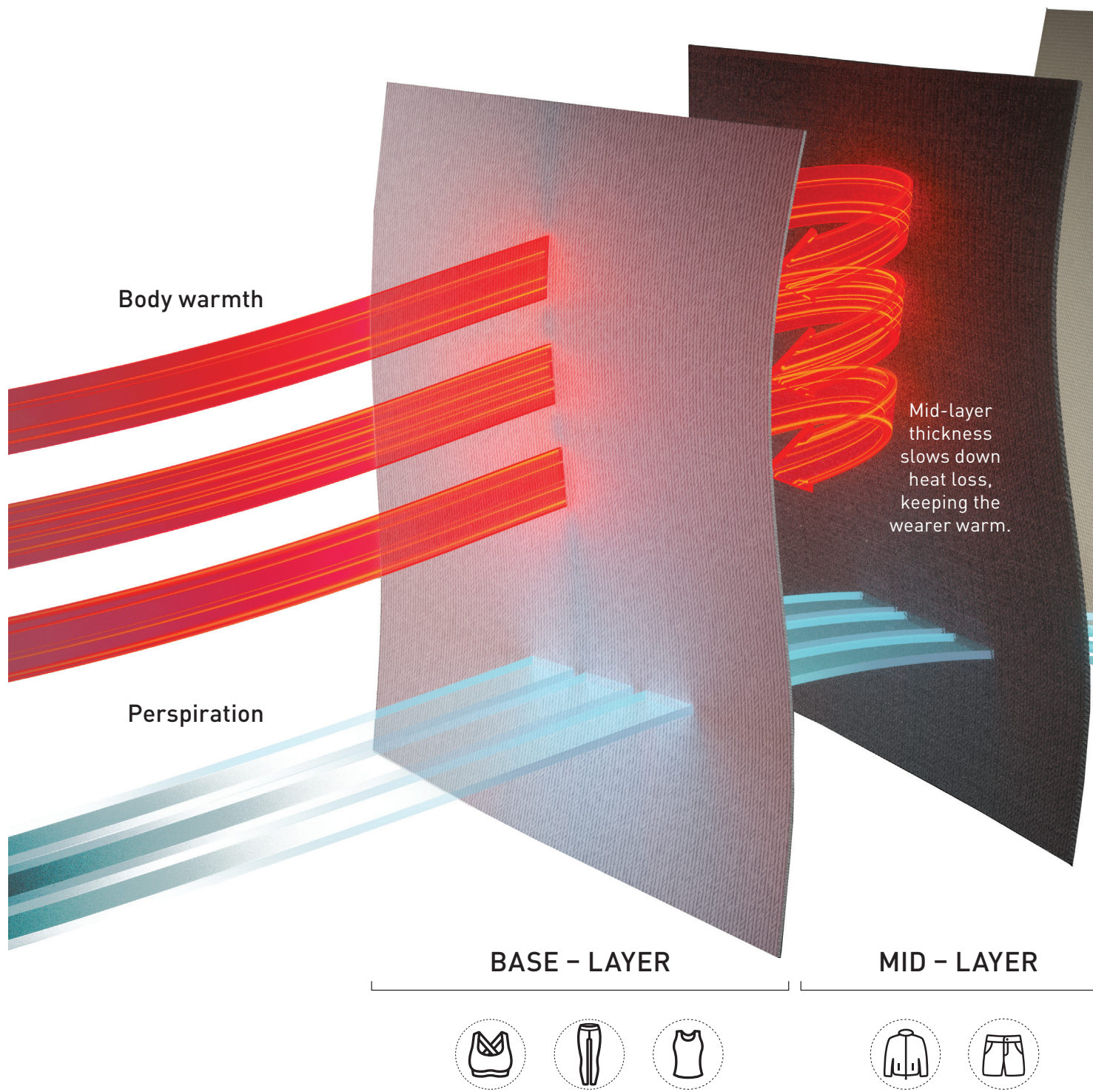
## ELASTIC

The natural elasticity of Merino wool helps Merino wool garments stretch and return to their original shape. Wool fibre can extend by more than 30 percent of its own length and bend up to 20,000 times before breaking which makes the fibre ideal for activewear.

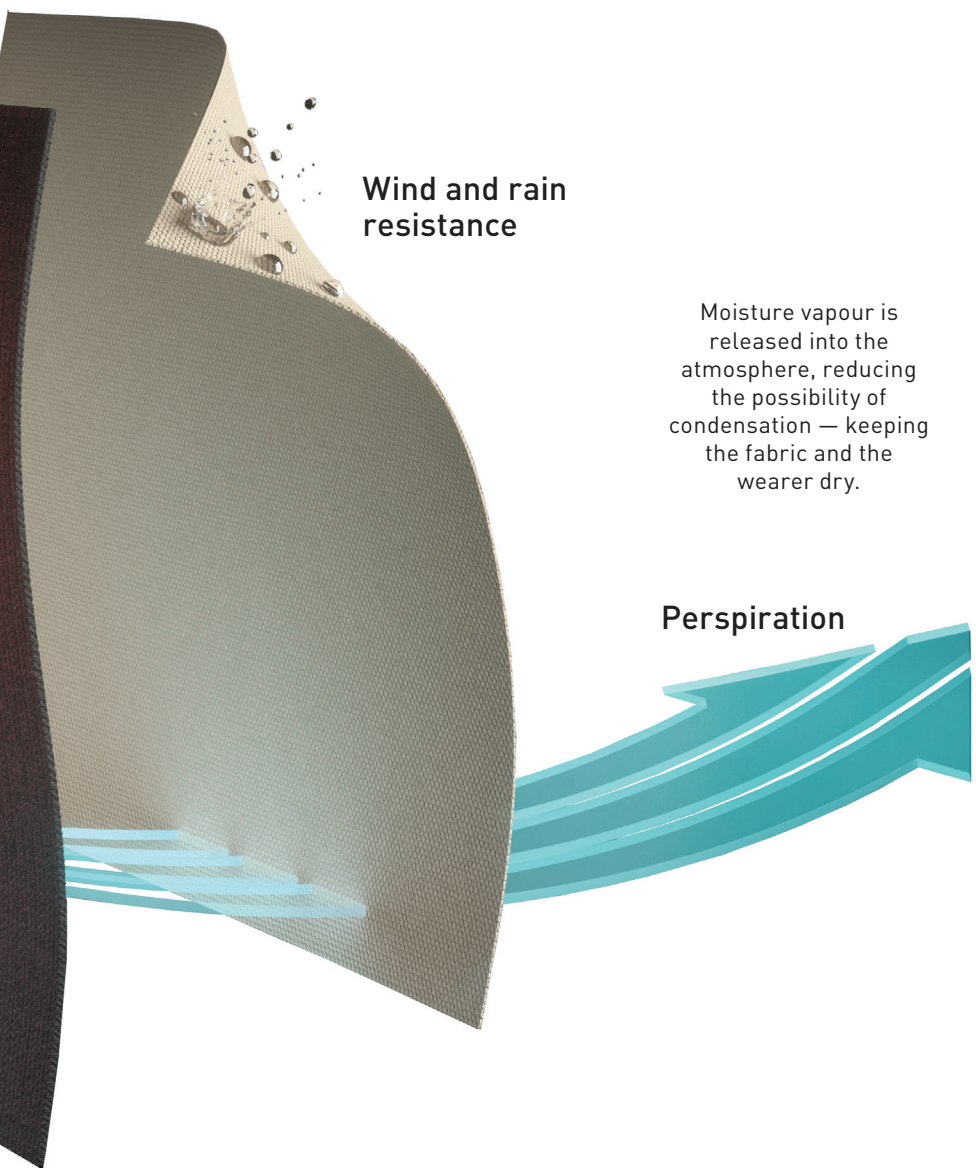
# THE LAYERING SYSTEM

In the area of performance apparel, the layering system gives the wearer the opportunity to adjust the clothing to the environment as well as to the activity level.

The unique moisture management, buffering, insulating and breathability properties of the Merino wool fibre work seamlessly together through all three layers, no matter the conditions: hot, cold or humid.



# Merino wool versatility



## OUTER - LAYER / GEAR

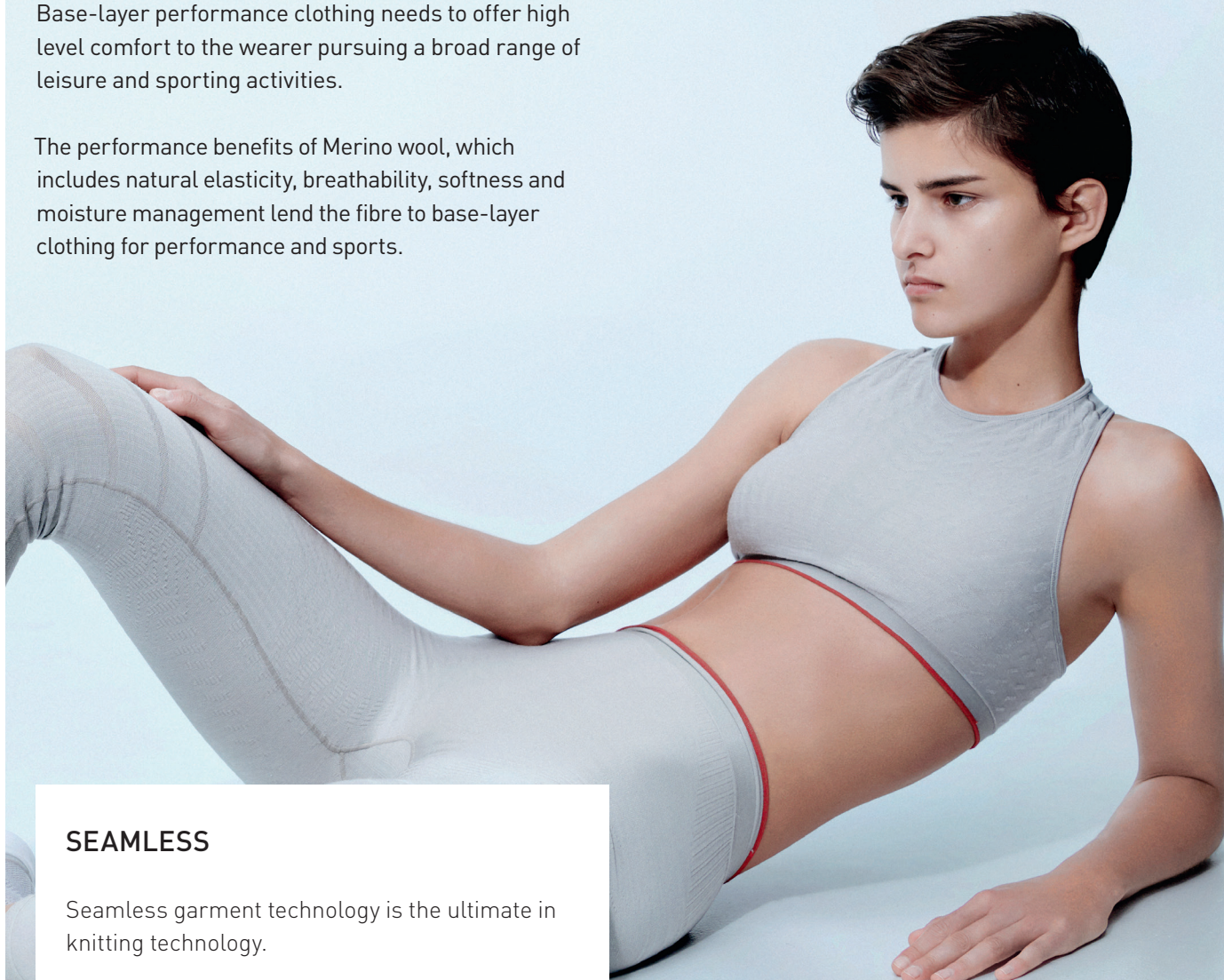


# BASE-LAYER



Base-layer performance clothing needs to offer high level comfort to the wearer pursuing a broad range of leisure and sporting activities.





The performance benefits of Merino wool, which includes natural elasticity, breathability, softness and moisture management lend the fibre to base-layer clothing for performance and sports.



## SEAMLESS

Seamless garment technology is the ultimate in knitting technology.

Circular and flat-knitting technologies are being employed to manufacture next-to-skin base-layers that feature:

-  Compression and breathability on a single surface
-  Greater structure diversity and comfort
-  Functionality zones
-  Reduction in textile wastage

Santoni x Suedwolle x Woolmark  
Merino wool seamless yoga wear




# Merino wool versatility



## WARP-KNITTING

Warp-knit construction sits between that of a knitted and woven fabric. It has flexibility yet its compact which is ideal for compression products that closely follow the contours of the body.

Warp knitting was for many years reserved for synthetics, but wool can now be integrated into this rigorous and fast knitting technique. The benefits of Merino wool warp knitting include:






-  Body contouring
-  Breathability
-  Enhanced elasticity



## COMPRESSION

Compression technology in base-layer garments has a number of benefits for the wearer. By including Merino wool into a compression knit structure the performance of the garment is further enhanced. There are multiple ways to construct a wool-rich compression fabric. The most common are warp knit and seamless technologies.

Merino wool compression base-layer garments have the benefits of:

-  High levels of stretch and recovery
-  Temperature regulation
-  Moisture management
-  Increased blood circulation
-  Odour management

# MID-LAYER



While the mid-layer garment's key function is to protect the wearer from the cold, the garment must also breathe so as to prevent the body from feeling clammy and humid.

Merino wool's ability to absorb humidity created by the body and release it on the outside ensures the wearer experiences the best possible microclimate conditions.

## BODYMAPPING MID-LAYERS

Body mapping is a knitting technology designed for maximum comfort in sport and active wear. Partial knitting creates 3D and shaped regions on garments, whilst pointelle stitching acts as in-built ventilation windows. Body mapping knitting technology promotes:



Temperature regulation



Increased blood circulation



Moisture management



Odour resistance

ashmei x Woolmark Merino wool  
Classic Long Sleeve Jersey






# Merino Wool versatility



## TERRY LOOP JERSEY




Terry loop jersey is ideal for sweat shirts and long-sleeve tops. The relaxed soft looped backing creates a 'terry' effect with a slightly stretchy knit to allow for a comfortable and lightweight garment.

100% Merino wool terry loop jersey has fluffy loop structure yarns inside the knit that provide a number of benefits including:

-  Moisture management
-  Enhanced thermal insulation
-  Warmth without weight

## SEAM BINDING AND SEALING

Taping for mid and outer-layer works perfectly for performance wear. Presented as either "no sew" taping or "seam sealing" both options have a number of benefits including:

-  Reduce air and water permeability
-  Added comfort
-  Enhanced temperature regulation

No sew construction taping also allows for lighter garments and increased comfort by reducing bulky seams.



# OUTER-LAYER



The outer-layer of high performance garments for outdoor activities and sports must comprise weather-protective fabrics.

The properties of Merino wool including breathability, insulation, water and wind resistance, and UV and fire resistance makes Merino wool suitable for high performance garments in all kinds of outdoor activities or sports, from low to high intensity.

## WOOL FILLING

Wool filling, in the form of fibre or small balls provides superior insulation for outer-layer garments. Unlike down, there is no catastrophic loss of thermal insulation with wool filling when wet and unlike polyester, wool filling has 25% less weight for the same degree of insulation.

Benefits of wool fill in jackets or sleeping bags include:



Superb thermal insulation



Moisture management







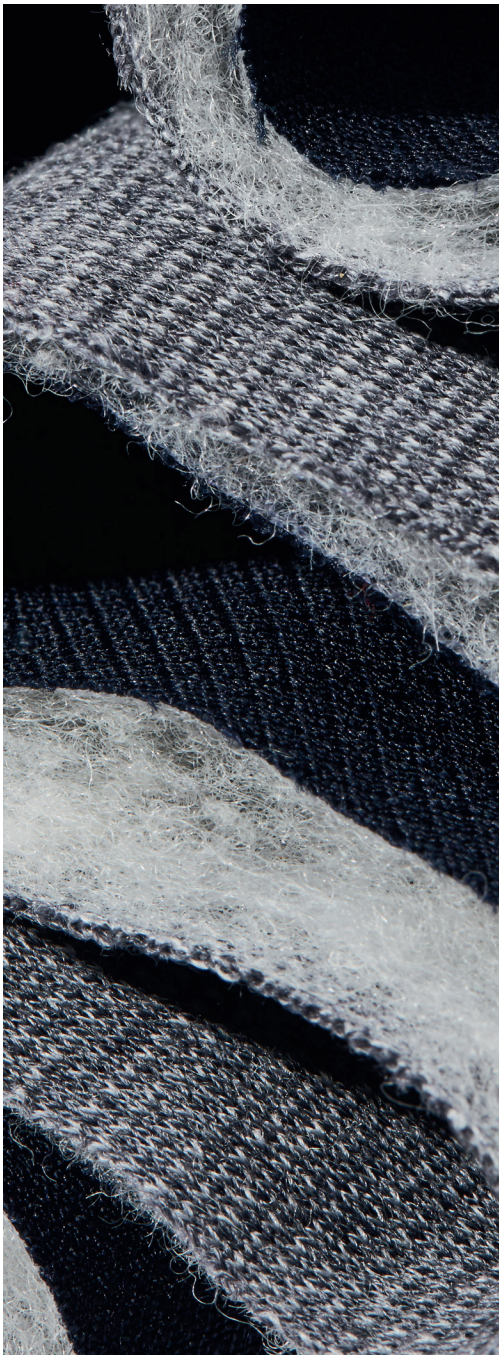
Warmth without weight

Prada x Woolmark Waterproof  
Three-layer Merino wool Jacket

## WIND AND WATER RESISTANT WOOL

Using Optim™ fibre stretching technology, wind and water-resistant fabrics are made with 100% Merino wool which is ideal for outerwear apparel. The technology works by pre-stretching the wool fibre and spinning it into yarn before being woven. The fabric then super-contracts during the dyeing and finishing process which creates a highly compact fabric without the need for chemical treatment. The performance benefits including:

-  Wind resistance
-  Water resistance
-  Odour management
-  Temperature regulation



## WOOL WADDING

A natural alternative to synthetic or down filling, wool wadding offers superior warmth per unit weight. The benefits of using wool wadding include:

-  Breathability
-  Efficient insulation
-  Dry microclimate in damp conditions
-  Warmth without weight

# Merino wool versatility

# GEAR

APL x Woolmark  
TechLoom breeze  
Merino wool runner



High performance gear such as socks, gloves, beanies and shoes are key items of clothing that play a crucial role in maintaining comfort of the body's extremities.

The inclusion of Merino wool will benefit the wearer due to the fibre's inherent qualities of temperature regulating and moisture management.

The head is the most important part of the body to keep warm. A beanie made with Merino wool regulates temperature, moving moisture from the head to the outside of the beanie helping keep the wearer dry and comfortable.





Socks and gloves containing Merino wool have performance benefits including odour control, breathability, moisture absorption and temperature regulation.

High performance sneakers and other varieties of innovative shoes benefit from wool's natural elasticity, odour management, shape retention and comfort.

## COMPRESSION SOCKS

Compression technology in socks has a number of benefits for the wearer and by including Merino wool into a compression knit structure the performance of the sock is enhanced. There are multiple ways to construct a wool-rich compression fabric. The most common are warp knit and seamless technologies.




Merino wool compression socks have the benefits of:

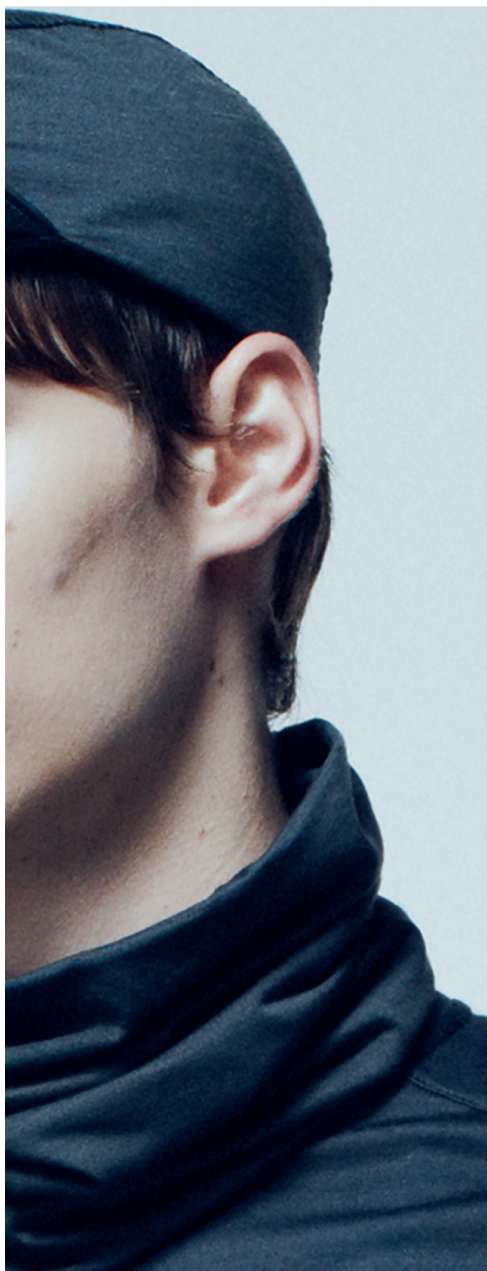
-  Temperature regulation
-  Moisture management
-  Increased blood circulation
-  Odour management

# Merino wool versatility

## WOOL INSOLES






Crucial to the comfort and performance of shoes, the insole is responsible for a number of performance attributes. Wool insole inserts are available for performance and casual shoes. The insoles can be made a number of ways, most innovatively using circular and warp knitting techniques. By incorporating wool into the insole of the shoe, performance benefits include:

-  Odour management
-  Enhanced comfort
-  Temperature regulation



## BEANIES AND HEADWEAR

The head is the most important part of the body to keep warm. Incorporating Merino wool into beanies and headwear ensures superior comfort for the wearer with the performance benefits of:

-  Temperature regulation
-  Moisture management
-  Warmth without weight
-  Breathability
-  Odour management

## SOURCING



### THE WOOL LAB

Sourced from more than 100 of the world's best spinners, knitters and weavers in our global supply network, The Wool Lab is the premier seasonal guide to the latest innovations in wool fabric. Connecting designers, brands and manufacturers directly to suppliers of yarn and fabric, The Wool Lab is freely accessible through consultation with Woolmark representatives.

## EDUCATION



### WOOLMARK LEARNING CENTRE

The Woolmark Learning Centre offers an unprecedented level of textile industry knowledge, freely accessible. From fundamental to masters level coursework, the platform offers the global textile industry expert-led knowledge, resources and programs across disciplines in the supply chain to achieve knowledge transfer and transparency. [woolmarklearningcentre.com](http://woolmarklearningcentre.com)

## PRODUCT DEVELOPMENT



### TECHNICAL TEAM

We have a dedicated technical team of experts that have specialist knowledge in all areas of the supply chain and are available to assist our partners with technical transfer, troubleshooting, process and product development and supply chain optimisation. We develop new processes and products bespoke to our partners in order to commercialise innovations in yarns, textiles, garments, products and processes.



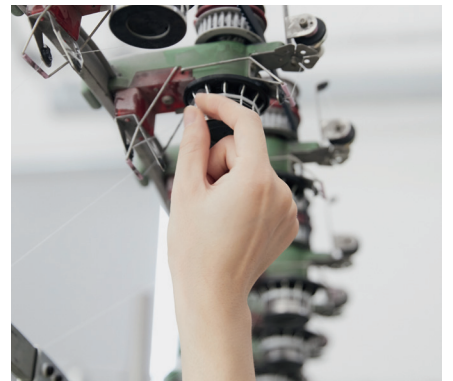
### SUPPLY CHAIN OPTIMISATION

We partner with designers, brands and retailers to commercialise new wool product lines. We offer design team support with supply chain assistance, quality assurance, seasonal consultation, product innovation and marketing.



### RETAIL TRAINING

We offer comprehensive training sessions for retailers and brands to not only educate staff about the benefits and versatility of wool, but to ultimately allow them to maximise their sales of wool product.



### INDUSTRY RESEARCH

We take the lead in funding and delivering research that innovates what wool is capable of, and ensure what wool means to the market is ever-evolving. These breakthroughs in fibre science, traceability and practices that promote sustainability and animal welfare are passed onto the industry and our partners have access to the latest research and information.

## CERTIFICATION

The Woolmark licensing program is a quality assurance and product certification program for wool textiles. Products with our logo certify the quality of wool fibre content to both consumers and the supply chain.



PURE NEW WOOL



WOOL RICH BLEND



WOOL BLEND  
PERFORMANCE

## WOOLMARK LICENSEES

We promote our Woolmark licensees throughout our global network and support them with supply chain assistance, quality assurance, technical consultation, product innovation, marketing and promote their product throughout our network. Woolmark licensees have been awarded the Woolmark logo to signify the quality assurance of their product.



**TO ENQUIRE ABOUT OUR  
SUPPORT AND SERVICES,  
CONTACT YOUR LOCAL  
WOOLMARK REPRESENTATIVE.**

# Our services

## REFERENCES

<sup>1</sup> Jambeck, J. R., et al. Plastic Waste Inputs from Land into the Ocean. *Science*, vol. 347, no. 6223, 13 Feb. 2015

<sup>2</sup> Boucher, J., Friot, D. Primary microplastics in the oceans: a Global Evaluation of Sources. International Union for Conservation of Nature, 2017.

<sup>3</sup> A New Textile Economy: redesigning fashion's future. Ellen MacArthur Foundation, 2017.

<sup>4</sup> A New Textile Economy: redesigning fashion's future. Ellen MacArthur Foundation, 2017.

<sup>5</sup> Russell S.J., et al. Review of wool recycling and reuse. Proceedings of 2nd International Conference on Natural Fibers, 2015.



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