

# WOOL IS NATURALLY BREATHABLE



Wool fibres are naturally breathable. They can absorb large quantities of moisture vapour and allow it to evaporate, making wool garments feel less clingy and more comfortable than garments made from other fibres. In contrast to synthetics, wool is an active fibre that reacts to changes in the body's temperature, keeping the wearer comfortable. Accordingly, wool garments are one of the most breathable of all the common apparel types.

Wool's natural resistance to odour is another key reason why wool wins for activewear.

## EFFECTIVE MOISTURE AND TEMPERATURE MANAGEMENT

Wool helps to protect the body against changes in temperature and moisture levels during exercise. Exercise causes the body's metabolic rate and temperature to increase, and the body responds by initiating cooling mechanisms to maintain its core temperature. As physical exertion can take place in a range of environmental conditions – from skiing in the Arctic to running in a desert – the type of clothing worn has a major impact on the performance and health of the body.

MOISTURE VAPOUR UPTAKE

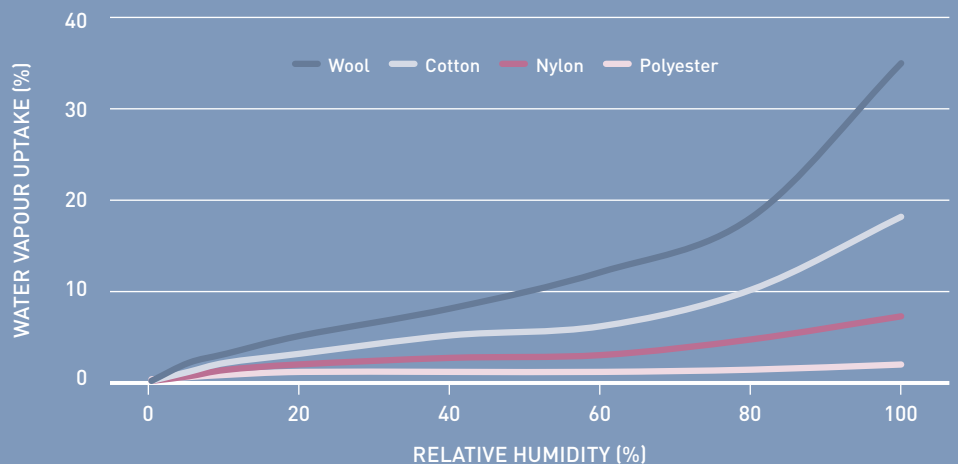
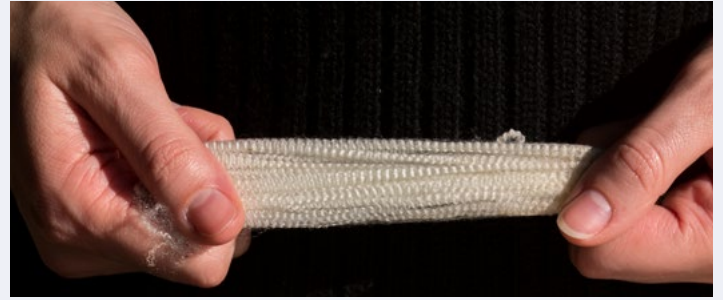


Figure 1: Moisture vapour uptake of wool and other common apparel fibres.

## WOOL IS NATURALLY BREATHABLE

### WOOL'S NATURAL CRIMP PROVIDES SUPERIOR INSULATION

The inherent natural 3D crimp of the wool fibre traps pockets of still air, insulating your skin from the cold environment and keeping you warmer. Wool maintains a drier microclimate next to skin, keeping the wearer warm and dry.



### WOOL REDUCES POST-EXERCISE CHILL

Wool reduces the rate of skin cooling and the severity of post-exercise chill, which can range from uncomfortable to dangerous. When you stop exercising in very cold conditions, you can experience three times more chilling in synthetic garments than when wearing wool garments. This is due to wool fibre retaining – and only slowly releasing – moisture from within its structure, helping to maintain a higher skin temperature and less rapid cooling.

Unlike most synthetic fibres, wool is hygroscopic. It absorbs water vapour from its surrounding environment far more effectively than other common apparel fibres. Wool can absorb up to 35% of its weight before feeling wet and clinging to the skin. As absorption occurs, wool releases heat, keeping the wearer feeling warmer and drier in cold damp conditions. One kilogram of dry wool can release heat equivalent to an electric blanket running for eight hours.

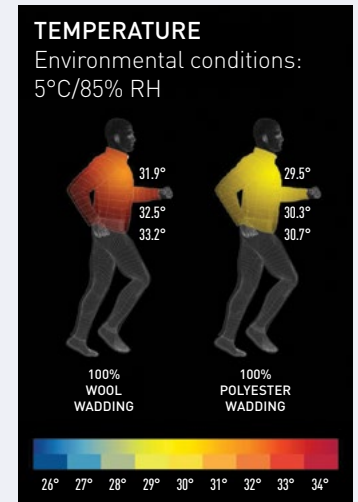
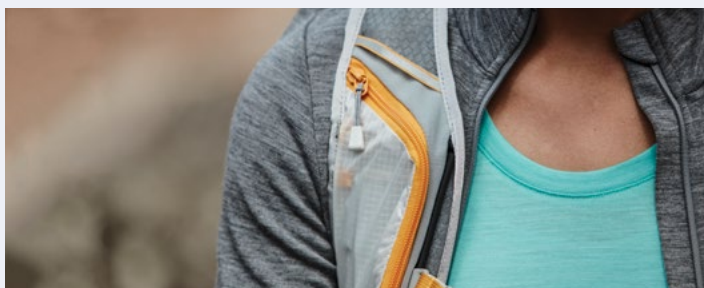


Figure 2: Wool-filled jackets keep the skin microclimate drier (left) and warmer (right) across the torso, compared to polyester-filled jackets. This has been tested in cold, damp conditions during walking at 5°Celsius/85% relative humidity.



### WOOL KEEPS YOU COOLER IN HOT, DRY ENVIRONMENTS

In warm environments, wool fabrics can feel up to two times cooler to touch than synthetic fabrics, because wool conducts more heat away from your skin. When it is hot and dry, wool keeps you cooler, by transferring moisture vapour away from the skin and allowing it to evaporate. Wool fabrics can move 25% more moisture away from your skin than polyester fabrics, equivalent to an ambient temperature drop of up to four degrees Celsius.



### ODOUR RESISTANCE

Wool garments and textiles are naturally odour resistant due to the fibre's unique properties. Wool's complex chemical structure enables it to absorb and lock away odours within the fibre, only releasing them upon washing. See the Wool is Naturally Odour Resistant fact sheet for further information.

### REFERENCES

Making wool garments feel less clingy and more comfortable than garments made from other fibres:

- Li Y. *The science of clothing comfort*, Textile Progress, vol. 31, 2001, 1 – 135.
- Li Y, Holcombe B.V, and Aparcar. *Moisture Buffering Behaviour of Hygroscopic Fabric During Wear*. *Text.Res.J.*, 1992, Vol62, 619-627.

Wool is an active fibre that reacts to changes in body temperature as well as the environment Y. Li, "The science of clothing comfort," Textile Progress, vol. 31, pp. 1 – 135, 2001. p 95.

Wool garments are the most breathable of the common apparel types: A. Rae and R. Bruce, *The Wira Textile Data book*, Leeds: The Wool Industries Research Association, 1973, A64.

The type of clothing being worn can have a major impact on the performance as well as the health of the body: Laing R. M. and Sleivert G. G, *Clothing Textiles and Human Performance*, Textile Progress, vol. 32, no. 2, pp. 1 -122, 2002. [28, p. 1]

Wool maintains a drier microclimate next to skin, keeping the wearer warm and dry. Troynikov, O. Hutton, S., Watson, C. & Nawaz, N. *Thermo-physiological comfort of Stop-go sports apparel – Sweating Thermal Manikin Studies*, RMIT, 2013/ Australian Wool Innovation p100.

Figure 1: Moisture vapour uptake of wool and other fibres showing how wool is one of the best of the common apparel fibres:

- Rae and R. Bruce, *The Wira Textile Data book*, Leeds: The Wool Industries Research Association, 1973, A64
- Speakman J. B & Cooper C. A. *The Adsorption of Water by Wool, Part I – Adsorption Hysteresis*, *Journal of the Textile Institute Transactions*, 1936 27:7, T183-T185 (<http://dx.doi.org/10.1080/19447023608661680>).
- Urquhart, Alexander Robert B.Sc., A.I.C. and Williams, Alexander Mitchell M.A., D.Sc. *The effect of temperature on the absorption of water by soda boiled cotton*, *Journal of the Textile Institute Transactions*, 1924, 15:12. (<http://dx.doi.org/10.1080/19447022408661326>)

The inherent natural 3D crimp of the wool fibre traps pockets of still air, insulating your skin from the cold environment and keeping you warmer: W. Von Bergen, *Wool Handbook*, Third ed., vol. 1, Wiley Interscience, 1963, 205.

Wool protects the body against changes in temperature and moisture levels during exercise: Li, Y. Holcombe B. V. and Aparcar F., *Moisture buffering behaviour of hygroscopic fabric during wear*, *Textile research Journal*, 1992, 619-627.

Wool reduces the rate of skin cooling and reduces the severity of post-exercise chill, which can range from uncomfortable to dangerous: Gavin, T. P. *Clothing and thermoregulation during exercise*, *Sports Medicine*, 2003, 941- 947.

When you stop exercising in very cold conditions, you could experience three times more chilling in synthetic garments than you will wearing wool garments: Troynikov, O. Hutton, S., Watson, C. & Nawaz, N. *Thermo-physiological comfort of Stop-go sports apparel – Sweating Thermal Manikin Studies*, RMIT, 2013/Australian Wool Innovation, p99.

Helping to maintain a higher skin temperature and less rapid cooling: Holmer, I. *Heat Exchange and Thermal Insulation Compared in Woolen and Nylon Garments During Wear Trials*, *Textile Research Journal*, 1985, 512-518.

One kilogram of dry wool can, on absorbing 35% of its weight in moisture, release heat equivalent to an electric blanket running for 8 hours:

- Stuart, I. M and Schneider A, M. *Perception of the Heat of Sorption of Wool*, June 1989, 324.
- B. Holcombe, *Wool Performance apparel for sport*, *Advances in wool technology*, Woodhead Publishing Limited, 2009, 272.

Figure 2: Skin temperature and relative humidity during walking at 5°Celsius/85%RH show wool-filled jackets keep the skin microclimate drier (left) and warmer (right) in cold damp conditions compared to polyester filled jackets: O. Troynikov, N. Nawaz and C. Watson, *Thermal Performance of Wool-containing Jackets in Cold Environments*, Australian Wool Innovation, Melbourne, 2014. 14

In warm environments, wool fabric can feel up to two times cooler to touch than similar man-made fabrics: Barnes, JC and Holcombe, *Moisture Sorption and transport in clothing during wear*, *Textile Research Journal*, 1996, 77-786.

Wool fabrics can move more than 25% moisture (which contains heat) away from your skin... equivalent to an ambient temperature drop of up to four degrees: J. C. Barnes and B. V. Holcombe, *Moisture Sorption and transport in clothing during wear*, *Textile Research Journal*, 1996, 77-786.

Wool has natural odour resistance: CSIRO, *Odour and Toxics Absorbtion*, 2006, 1.

Next-to-skin wool garments slow the rate of change of humidity next to the skin,.: Laing R. M. and Sleivert, G. G. *Clothing Textiles and Human Performance*, Textile Progress, vol. 32, no. 2, 2002, 1 -122.

Wool helps transfer more body heat from the skin to the atmosphere than synthetic fibres: J. C. Barnes and B. V. Holcombe, *Moisture Sorption and transport in clothing during wear*, *Textile Research Journal*, 1996, 77-786.

